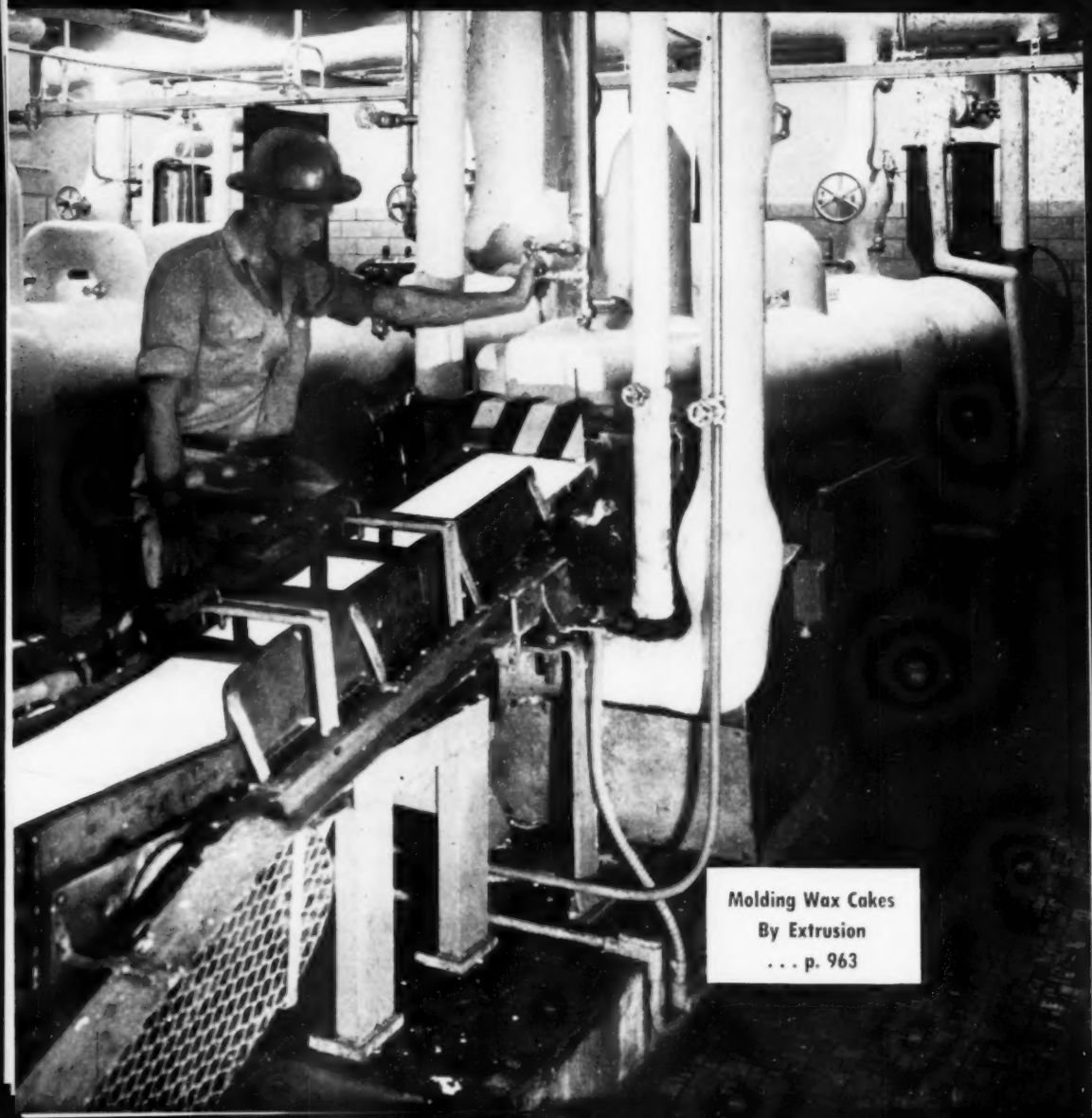
SEPTEMBER, 1951
VOL. 6, NO. 9

PETROLEUM PROCESSING



Molding Wax Cakes
By Extrusion
. . . p. 963

BULLETINS ON HUDSON TOP PERFORMANCE Cooling Towers and Air Cooled Exchangers mailed on request.

HUDSON
Top Performance
COOLING EQUIPMENT

COOLING TOWERS
AIR COOLED EXCHANGERS
ATMOSPHERIC SECTIONS

Undivided Responsibility—Complete integration in the selection and design of cooling equipment best suited to specific installations results in minimum first cost and minimum operating cost—and the responsibility is undivided.

HUDSON
ENGINEERING CORPORATION
FAIRVIEW STATION • HOUSTON, TEXAS

ETHYL CORPORATION

4,372 years of antiknock experience

This photograph will give you some idea of the experience that Ethyl brings to bear on oil-industry problems.

Assembled on the lawn in front of the Ethyl Research Laboratories in Detroit are some of our 432 full-time specialists in antiknocks, fuels, lubricants and engines. These researchers have an average of 18 years' experience in their varied fields, including an average of 10 years with Ethyl. The experience of this team, with Ethyl, adds up to a total of 4,372 years.

Like the faculty of a great university, a team of this caliber can be created only over a long period of time. While it is possible to hire individuals, the careful

Continued on next page

ETHYL
ETHYL CORPORATION

4,372 years of antiknock experience

Continued from preceding page

balancing and dovetailing of individual capabilities into an effective working group requires years. From such seasoning and experience have come the understanding of refiners' problems and the cooperation in their solution which have typified the work of the Ethyl team.

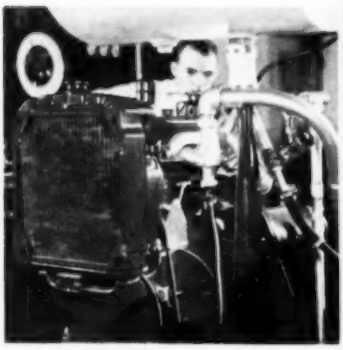
Ethyl started to build its fuels and engine research team in 1923. Originally it was housed in a converted garage. Today it works in extensive laboratories at Detroit, San Bernardino and Baton Rouge, where it is equipped with the most complete and best of research facilities. But its guiding principles remain the same—"Do anything and everything that will assist refiners to get the maximum benefit from every drop of 'Ethyl' antiknock fluid."

ETHYL CORPORATION

NEW YORK 17, N. Y.

Experience *

is the most important ingredient in "Ethyl" antiknock compound

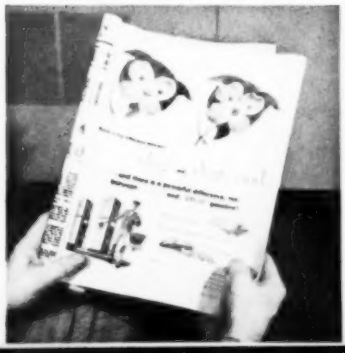


RESEARCH

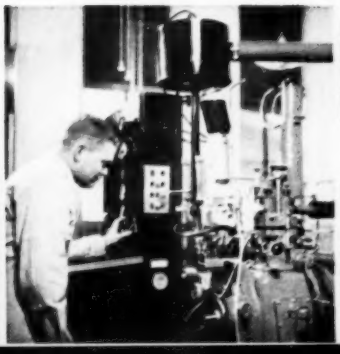
SUPPLY SERVICE

TECHNICAL NOTES

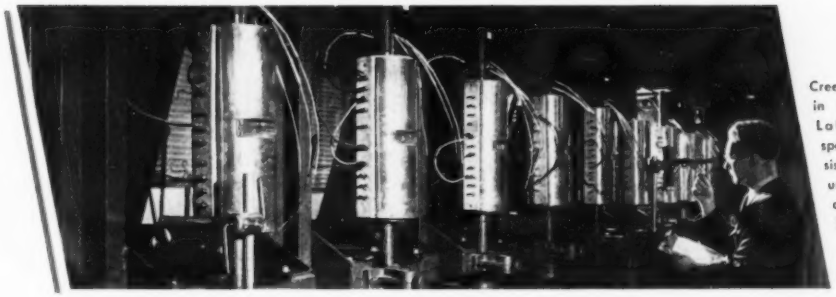
PREMIUM GASOLINE PROMOTION



GASOLINE TESTING



ROAD RATINGS INDOORS



Creep tests under way in INCO's Research Laboratory. Here specimens of heat-resisting alloys are held under constant load at temperatures up to 2100°F.

IS HIGH-TEMPERATURE PERFORMANCE YOUR PROBLEM?
INCO Engineers may have the answer...

Your *successful* selection of metals for high-temperature operations often requires more than a simple evaluation of mechanical properties of the material itself.

The most important factor may be a specific corrosive condition linked to the elevated temperature-environment—a trouble not apparent, perhaps, at moderate thermal levels. And as the trend to higher operating temperatures develops, new high-temperature corrosion problems follow.

Engineers who encounter high-temperature problems in their work with design, production, and operations may find Inco High-Temperature Engineering Service a valuable source of information.

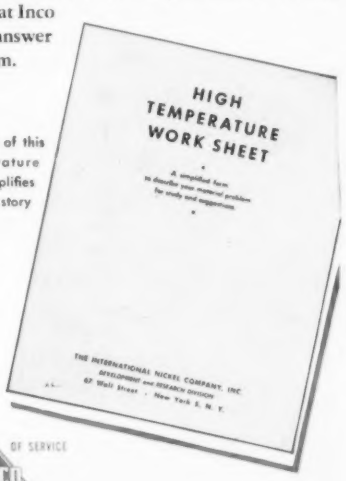
INCO'S HIGH-TEMPERATURE ENGINEERING SERVICE

As industry progressed, it used higher temperatures and required metals and alloys to withstand these temperatures. Inco Engineers have endeavored to assist by analyzing the requirements and furnishing experimental data for the selection of the material.

Inco laboratory facilities at Bayonne, N. J., and Huntington, W. Va., have assembled data on mechanical properties of metals at high temperatures . . . and performance under corrosive conditions. Constant research is adding to this fund of information. Inco Engineers in the field are learning of conditions that cause unsatisfactory performance and how best to remedy them.

In a field that grows so fast, it is obviously impossible to have an immediate answer to every problem. But each new problem solved or studied adds to the total of knowledge on the subject. So if *you* are having high-temperature problems – whether in an existing application or with a new project, let the Inco Engineers work with you. Send for our High-Temperature Work Sheet, a simplified form to set out your full story. And you may find that Inco can suggest an answer to your problem.

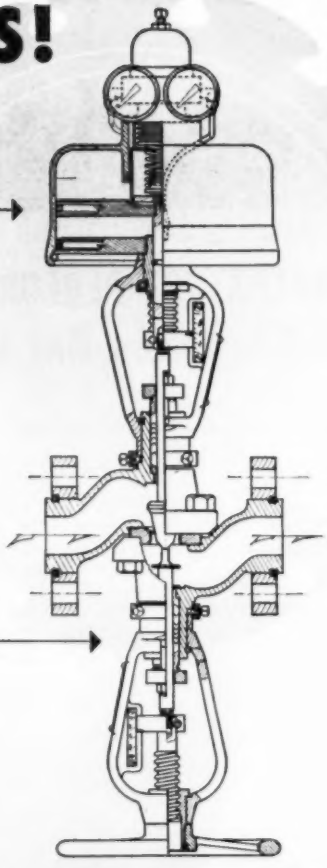
Send for your copy of this new High-Temperature Work Sheet; it simplifies gathering the full story of your problem.



EMBLEM OF SERVICE

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N.Y.

Here IT IS!



AUTOMATIC

DOMOTOR—For Automatic Control—Sealed piston in dome, actuated by internally controlled differential pressures, insures powerful stable valve action. Built-in null type positioner unit. Light weight, economical and flexible with proven dependability.

MANUAL

HANDWHEEL—For Manual Control—Perfect for those start-up periods or for operation during instrument repair. Provides positive manual control when desired or may be used as an adjustable limit stop. Incorporates advantages of continually connected control valve without the usual mechanical complications.

The Combination Valve you asked for

Now for the first time you get all the advantages of the powerful Domotor Valve plus the versatility of the Handwheel Valve combined in one valve. The single seated, split construction body that has already brought many advantages to valve buyers in the way of versatility, ease of maintenance and smooth flow has now made possible this newest achievement. The operational flexibility of this combination valve is unlimited—inventories are reduced—no changeover time—and as with all Annin valves, precise control of hard-to-handle fluids is assured. Write today for complete information.

REMEMBER—Teflon Chevron packing has been standard equipment on all Annin Valves for over two years.

ANNIN CONTROL VALVES

THE ANNIN COMPANY
3500 Union Pacific Avenue, Los Angeles 23, California

PETROLEUM PROCESSING

Covering petroleum research and the design, management, operation and maintenance of plants processing hydrocarbon materials into fuels, lubricants and chemicals

1213 West Third St., Cleveland 13, O.

A Platt Petroleum Publication

CCA

Warren C. Platt, *President*
Albert W. Boulton, *Vice President*
A. E. Kraft, *Treasurer*

Editorial Staff

Virgil B. Guthrie, *Editor*
William F. Bland, *Engineering Editor*
William C. Uhl, *Equipment Editor*
D. P. Thornton, Jr., *Southwestern Editor*
810 First Nat'l. Bank Bldg., Houston 2.
Frank Breese, *West Coast Editor*
416 West 8th St., Los Angeles 14.
Verne Nazarek, *Production Manager*
Peter J. Gaylor, *Patent Reviewer*

Editorial Affiliates

H. A. Yocom, *Washington Bureau Chief*

Advertising Sales Staff

K. W. McKinley, *Manager*

Regional Representatives

NEW YORK 20, N. Y.
P. S. Carberry, 50 West 50th St.
PHILADELPHIA 2, PA.
C. J. Jeffers, 1422 Chestnut St.
CHICAGO 5, ILL.
R. D. Henriquez, 59 East Van Buren St.
CLEVELAND 13, OHIO
Richard N. Jorgenson, 1213 West 3rd St.
HOUSTON 2, TEXAS
George Reid, 810 First Nat'l. Bank Bldg.
SAN FRANCISCO 4, CALIF.
Robert W. Walker Co., 57 Post St.
LOS ANGELES 5, CALIF.
R. W. Walker, 2330 West 3rd St.

Published second Tuesday of each month by National Petroleum Publishing Co., 1213 West Third St., Cleveland 13, Ohio. Subscriptions: $8.00 a year in U.S. and possessions, $8.50 a year elsewhere. Single copies, 75 cents each; back copies more than three months old, $1.00 each. Microfilm copies available through University Microfilms, Ann Arbor, Mich. *Petroleum Processing* is indexed regularly in Industrial Arts Index, Engineering Index and Chemical Abstracts. Published prior to Sept., 1946, as the *Technical Section of National Petroleum News*, devoted to Refinery Management and Petroleum Chemical Technology, and including *International Petroleum Technology*. Trade mark registered U.S. Patent Office.

Copyright 1951 by National Petroleum Publishing Co.

Acceptance under the act of June 5, 1934, at Cleveland, Ohio, authorized Dec. 22, 1948.

Other Platt Petroleum Publications

Platt's Oilgram News
A daily independent oil-news reporting service issued from New York, Cleveland, Houston

National Petroleum News
The weekly oil marketing magazine, covering news prices, transportation, storage, merchandising

Platt's Oilgram Prices
A daily independent, oil-price reporting service issued from New York, Cleveland, Houston

September, 1951
Vol. 6, No.9

Contents

Feature Articles

New Method of Slabbing Wax **963**
Texaco installation forms cakes by extrusion, can turn out 66 tons/day with one operator, *by D. P. Thornton Jr.*

WANTED! Steel Scrap for Defense **968**
Sohio refinery "mines" 3575 tons of it in 2½ years

Chemistry of Inhibitor Sweetening **969**
Discussion of original experimental work aims at better understanding of this process and its applicability, *by R. H. Rosenwald*

How to Get What You Need When You Order a Pump **974**
No. 3 in a series on How to Order Equipment, *by D. P. Thornton Jr.*

Smokeless Flare Stacks **978**
Steam injection technique provides inexpensive and successful answer to air pollution problem, *by W. H. Smolen*

REFINERY INSTRUMENTS—What Makes Them Tick? **983**
Part 3—Liquid Level Measurement, *by C. E. Shannahan*

Refining Properties of New Crudes **987**
Part 5—Characteristics of Crude Oils from the "Golden Trend" in Oklahoma, *by N. A. C. Smith, H. M. Smith and C. M. McKinney*

FAWLEY—New Era in Refining in Europe **992**
Crude units at Esso's 130,000 b/d refinery in England now on stream, final completion due in 1953, *by V. B. Guthrie*

Fawley Will Make 12,000 Tons of Sulfur Annually **996**

Graphitization Appraised by Metallurgist **997**
Refiners aren't the only ones who have experienced high temperature deterioration of carbon steel in vessels and piping

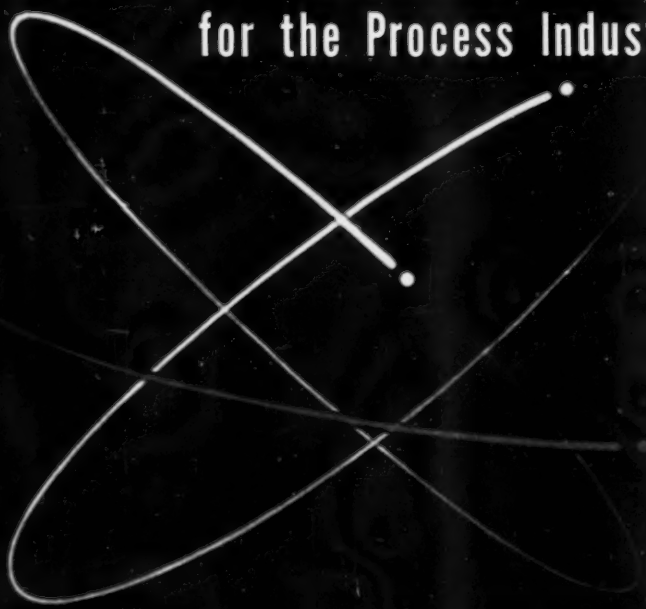
Gun-applied Refractory Linings **1000**
Some practical answers to questions on their application and use in refineries

Departments

What's Happening	931	News of Suppliers	1017
Tomorrow	935	Books	1021
News in Views	991	Meetings	1023
Plant Practices	1005	Refining Trends	1025
Processing Patents	1009	What's New	1029
Equipment Patents	1013	Personals	1041
Editorial	1044		

Announcing...

A revolutionary new electronic control system for the Process Industries



You are cordially invited to inspect the new Swartwout Autronic Control System for precise, automatic measurement and control of temperature, pressure, level, and flow. This compact electronic system is the ultimate in centralized control. It will be publicly displayed for the first time at the Sixth National Instrument Exhibit, Houston, Texas, from September 10th to 14th, inclusive. We look forward to seeing you at Booths 324-346. Or if you are unable to attend in person, write for literature on the new Swartwout Autronic Control System.

Swartwout *Autronic* **CONTROL SYSTEM**

THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

THE GRAVER EXPANSION ROOF

FIRE-SAFE!

ACCORDING TO UL STANDARDS

"The use of an expansion roof on a storage tank handling volatile petroleum products is considered to be conducive to the reduction of the fire hazard, and to the conservation of the liquid stored." That's the conclusion reached by Underwriters' Laboratories, Inc., as a result of their examination of the Graver Expansion Roof.

The report continues: "A study of the design showed that the possibility of sparks being struck by moving parts is not likely, and that metallic contact between the roof and the shell reduces the danger from the generation of static electrical charges."

No Graver Expansion Roof has ever been involved in a fire during the decade since the design was originated. This further substantiates the Underwriters' seal of approval.

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

NEW YORK • CHICAGO • PHILADELPHIA • WASHINGTON • DETROIT • CINCINNATI
CATASAUQUA, PA. • HOUSTON • SAND SPRINGS, OKLA.

GRAVER

The Man Who Hates "Desk Jockeys"

Unlike those of us who, of necessity, are swivel-chair pilots, Virgil Guthrie has a modus operandi that makes it mandatory for him to be on the move.

"Guth", editor of *Petroleum Processing* and a veteran of 35 years in reporting refining activities, found out long ago that the way to ferret out accurate technical and marketing information in the petroleum refining industry is to be "on the spot". And, like Guthrie, *Petroleum Processing*'s entire staff, the largest and most experienced editorial staff exclusively devoted to the specialized interests of oil refining, believes that by being present where the things they write about are happening, they can best be of service to refining men everywhere.

That's why refining men accept *Petroleum Processing* as their source of accurate information on technical developments in the industry and for complete and expert analyses of market trends. That's why these men, key buying factors in this market, will read *your* message . . . if it's printed in the pages of *Petroleum Processing*, the publication that's edited by experts, for experts in the refinery industry.

THE BEST-READ REFINERY PUBLICATION
REACHING THE MOST REFINERY READERS

A Platt Petroleum Publication

Headquarters, 1213 W. Third St., Cleveland 13, Ohio . . . Offices in New York, Chicago, Philadelphia, Houston and Los Angeles

WHAT'S HAPPENING

Current News Summarized For Oil Men

Expansion

Cosden Petroleum Corp. will install the first unit using the new UDEX process for separating aromatics. It will be installed at its Big Spring, Tex., refinery, and will have a charge capacity of 1,500 b/d. Universal Oil Products, which developed the process in cooperation with Dow Chemical Co., is doing design and engineering, with construction being handled by Procon, Inc. Completion is scheduled for late next summer.

Roosevelt Oil & Refining Co. is also installing a UDEX unit, 1,100 b/d, as well as an 1,800 b/d Platformer and a 450 b/d "aromatic treating" unit at its Mt. Pleasant, Mich., refinery. Design and engineering by Universal Oil Products; construction by Procon. Completion expected next July.

Sun Oil Co. plans to build a 10,000 b/d UOP Platforming unit at its Toledo, Ohio, refinery. Also planned is a 4,000 b/d propylene polymerization unit. Projects are part of a $40 million refinery expansion program Sun expects to complete during next two years, and which includes a new refinery at Sarnia (August "What's Happening") and a catalytic reforming unit at Marcus Hook, Pa. (July "What's Happening").

International Refineries, Inc., of Minneapolis, Minn., plans to build a new 11,500 b/d refinery in Carlton County, Minn., at an estimated cost of $7 million. Plant will process Canadian crude, will include Fluid catalytic cracking, and is expected to be in operation by October 1952. Construction contract has been let to Lummus Co. Entire output of refinery has been sold to Western Oil & Fuel Co.; H. M. Baskerville is president of both companies.

Ohio Oil Co. will expand its 30,000 b/d Robinson, Ill., refinery to 40,000 b/d. Program is expected to require 18 months to complete. New units to be built include a 6,000 b/d coking unit and a 7,000 b/d catalytic reforming unit.

World's largest cat cracker, Gulf Oil's new 60,000 b/d Fluid unit at Port Arthur, Texas, was scheduled for start-up shortly after Labor Day.

Natural Gasoline

Phillips Petroleum Co. will start construction at once on its new Spraberry natural gasoline plant in Midland County, Texas. The plant will initially process 100 million cu. ft. of gas daily, and will be extended to handle all additional gas discovered as field development continues.

Skelly Oil Co. is proceeding with the engineering, design, purchase of materials and actual construction to more than double the capacity of its Velma Gasoline Plant at Velma, Okla., and to build a booster station for the delivery of casinghead gas to the plant. The plant and booster station will process a total of 73 million cu. ft. of gas daily.

Tex Harvey Gasoline Co. is re-erecting in the Tex Harvey pool of Midland County, Tex., a dismantled Michigan natural gasoline plant. Initial capacity will be 10 million cu. ft. per day, to be increased to 30 million cu. ft. per day later. Initial output of the plant, expected to be on stream by next January, will be 20,000 gals. each of natural gasoline and propane, and 10,000 gals. of butane.

Defense Department plans to spend $4,000,000 for a natural gasoline plant at Elk Hills naval petroleum reserve. Plant would have a capacity of 50 million cu. ft. per day.

Stanolind Oil & Gas Co. has awarded contract to Chemical Plants Division of Blaw-Knox Co. for a package-type gasoline stripping unit to be erected at the Gilliam gasoline plant near Shreveport, La. Unit will be designed to process 1½ million cu. ft. of gas daily at a pressure of 350 psi.

Crude Oil

A new oil field is coming into prominence in West Texas—the Spraberry Trend. The field is estimated to hold at least a billion barrels of recoverable oil, although one major oil company engineer told PETROLEUM PROCESSING that it "likely would bulk up to two or three billion barrels." The oil is in the vicinity of 36° gravity.

Crude oil productivity capacity in the U.S. can be boosted from a present average of about 6,830,000 b/d to about 7,845,000 b/d in 1955, according to a forecast released last month by PAD. Forecast is made on assumption that drilling will continue at about the 1951 rate.

Foreign

California Texas Oil Co. Ltd. plans to build a 13,000 b/d plant to make Diesel and fuel oils in Lebanon, at an estimated cost of $5,800,000. Completion is expected within two years.

Standard Vacuum Oil Co. plans to build a complete new refinery near Melbourne, Australia at a cost of about $17,000,000. New refinery will adjoin present

Information on these pages is obtained through the nation-wide news coverage service of PLATT'S OILGRAM NEWS

2,000 b/d Altoona plant of Vacuum Oil Co. Pty. Ltd., and will increase capacity there to more than 14,000 b/d. Project will include catalytic cracking.

Markets, Prices

August oil markets ran true to form, domestically. The usual vacation-month lull in domestic trading was more pronounced than ever, and, according to industry reports, only the large-scale foreign demand to offset production lost at Anglo-Iranian Oil Co.'s refinery in Abadan kept U.S. prices from "slumping, and slumping badly."

The total of purchases of refined production from U.S. sources made by Asiatic Petroleum Co. for export jumped from 15,000,000 bbls. at the end of July to more than 24,000,000 bbls. on Aug. 30. Inland as well as coastal refineries shared in the business and it afforded relief to top-heavy inventories in more than a few instances.

Refined products inventories were high, both at the secondary level and at refineries. The buildup in heating oil stocks in anticipation of record winter consumption is much further advanced than normally. Two instances of this trend are cited as typical of August trade reports:

One of the East Coast's largest tanker terminal operators leased additional storage this year beginning Aug. 1; usually it's late September or early October before his own tanks are full and leased storage is required.

A major supplier had to postpone until September and October cargo liftings of both light and heavy fuels scheduled for August at the Gulf Coast by several of his East Coast distributors because storage tanks already were "brim full."

Similar instances of ample inventories were cited in the Mid-Continent and Midwest.

Prices generally were unchanged for the principal refined products. Chicago District prices for distillate fuels, however, were off 0.125 to 0.25c per gal. as some terminal operators endeavored to move product to make room for incoming barge shipments. In the specialties, crude scale wax was off another 0.375c to 5.125c per lb. in Western Pennsylvania.

Industrial Mobilization

Steel needs of the refining industry for 1952 have been estimated by Petroleum Administration for Defense at 515,800 tons for new construction and 105,200 tons for maintenance, repairs and operations. It has formerly requested that amount from Defense Production Administration—for domestic, Canadian and foreign operations.

Alkylation capacity of U.S. refineries will be increased by 31,000 b/d to a total of 158,000 b/d. Stepup will be achieved by rehabilitating five old plants with aggregate capacity of 8,230 b/d and building 22,700 b/d of new capacity. Defense Department has requested $75 million to underwrite the program by guaranteeing continuation of avgas purchases over a period of five years and paying alkylation plant maintenance costs if, during that interval, plants are idle.

Further drastic cuts in tetraethyl lead supplies for civilian gasoline are seen as inevitable as a result of NPA's notice to TEL makers that their metallic lead allocations for September would amount to only about half what they had requested. PAD was trying to get cuts restored as of end of August, warning that the result otherwise would almost certainly be a quality reduction amounting to "several" octane numbers and a consequent impairment of essential transportation.

More sulfur than it uses in its own operations is now being produced by the petroleum industry—to the extent of 5,500 tons. PAD estimates that for 1951 gross requirements of industry for fresh sulfuric acid will be equivalent of 638,000 tons of sulfur. During that same period it will release a total of 643,500 tons—through direct acid-recovery and sulfur-extraction operations, from spent acids and acid sludges, and from hydrogen sulfide recovered from petroleum operations and supplied to the chemical industry. By end of 1952 surplus is expected to be some 196,000 tons because of new sulfur-recovery projects now in construction stage.

Two commercial synthetic fuels plants should be built immediately, according to Interior Secretary Chapman. He has asked authority to borrow $455 million from the Federal Treasury (under the recently amended Defense Production Act making Federal funds available to government departments and agencies to encourage expansion of productive capacity and supply). If he gets the fund, he intends to use $400 million to guarantee government purchase of the output, and thus the profits, on the proposed investment by a private group in a 30,000 b/d coal hydrogenation plant, to be located probably in southern Illinois. Construction of a $55 million shale oil plant of a "few thousand" barrels daily capacity would be underwritten in a similar manner.

Granting of fast tax write-offs has been suspended for a period of 60 days, effective Aug. 18, except for "most urgent projects." Moratorium is not expected to apply, however, to basic refinery expansion projects nor such special projects as avgas.

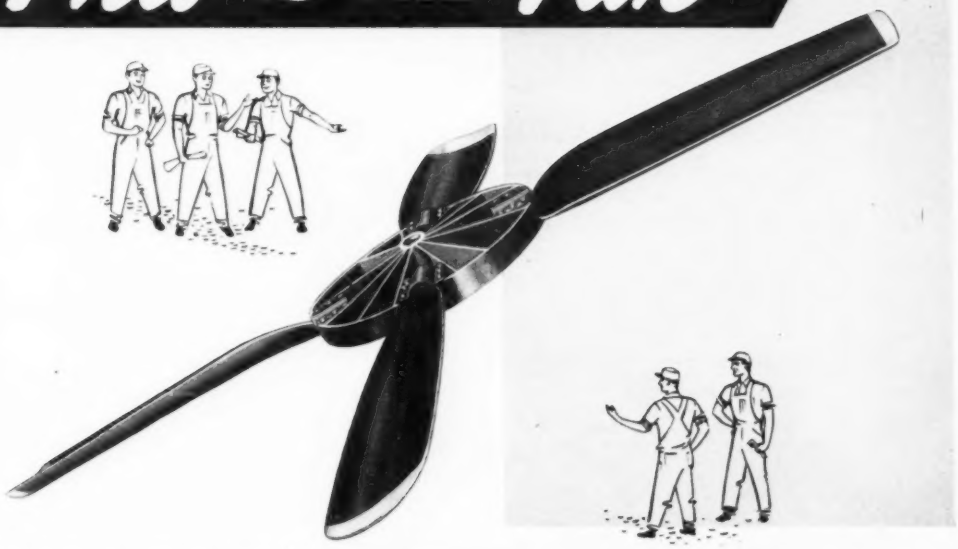
APPOINTMENTS—C. E. Davis (vice president in charge of refining for Shell) as Deputy Director of the Refining Division of PAD, succeeding **Reid Brazell,** who returned to the presidency of Leonard Refineries Sept. 1 . . . **E. Carl Mattern** (director of Oil Workers International Union) as a consultant to PAD . . . **Robert C. Steves** (formerly senior economic analyst with California Standard) as assistant director of PAD's Program Division, succeeding **Robert N. Sears,** who is returning to Phillips.

Transition

Cotton Valley Solvents, Inc., has been formed for purpose of operating former Premier Oil Refining Co. refinery at Cotton Valley, La. Plant was purchased late in July and is now running close to 3,000 b/d.

New York office of PAD has been moved from American Circle Bldg., 1834 Broadway, to Room 906, Building A, 270 Park Ave. Telephone Murray Hill 8-5150.

This IS THE *Fan*



COOLING TOWER WORKERS LIKE Because . . .

it operates day in and day out without trouble.

Cooling tower workers know that their reputation for steady, low-cost, efficient cooling tower operation goes up when Hartzell cooling tower fans go in. They know that this fan, even in the 22-foot size, has an amazing ability to withstand damage from vibration, abrasion, moisture, most acids and alkalies, salt and other deteriorating factors.

They know that every Hartzell cooling tower fan has adjustable blades. If air-volume needs change, blade pitch can be changed, within reasonable limits, to match the changed needs. That feature often saves the cost of a new fan.

They know that Hartzell hubs pack tremendous strength — far beyond any calculable needs.

In short, they know that properly installed Hartzell cooling tower fans are insurance of trouble-free, efficient air-movement for a long time to come.

Patented Hartzell features produce those results.

To be sure of fans your cooling tower workers will like because they'll do a better job, simply specify Hartzell. Most cooling tower builders use them regularly; all can obtain them. If you build your own tower, just ask a Hartzell user what fan you should use.

CLIP AND MAIL THIS COUPON NOW FOR INFORMATION

HARTZELL PROPELLER FAN CO.
Div. of Castle Hills Corp.
PIQUA DEPT. K **OHIO**

Name_____
Company_____
Street & No._____
City & State_____

PROPELLER-TYPE FANS AND BLOWERS—ROOF VENTILATORS—UNIT HEATERS • ENGINEERING OFFICES IN PRINCIPAL CITIES

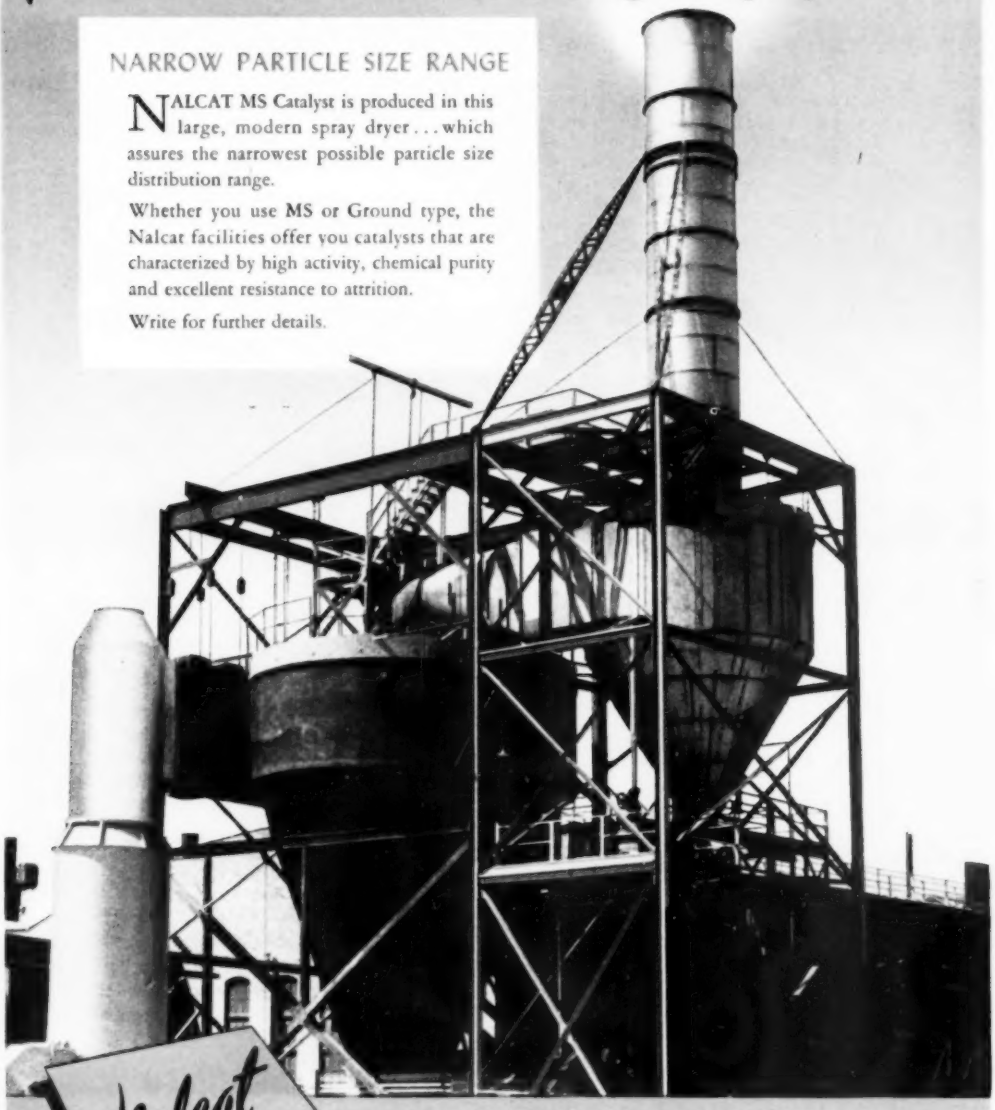
Nalcat MS CRACKING CATALYST from Latest Design Equipment

NARROW PARTICLE SIZE RANGE

NALCAT MS Catalyst is produced in this large, modern spray dryer . . . which assures the narrowest possible particle size distribution range.

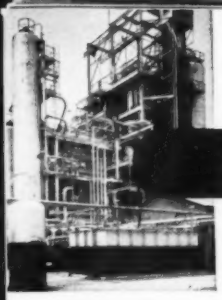
Whether you use MS or Ground type, the Nalcat facilities offer you catalysts that are characterized by high activity, chemical purity and excellent resistance to attrition.

Write for further details.



Nalcat MS AND GROUND TYPE CRACKING CATALYSTS

CATALYST DIVISION—NATIONAL ALUMINATE CORPORATION
4003 West 71st Street • Chicago 29, Illinois



TOMORROW... IN PETROLEUM TECHNOLOGY

Possible Effects of Today's Developments On Future Operations

By the Editors of Petroleum Processing

Vinyltoluene, New Styrene Substitute Could Ease Demand for Benzene

ANNOUNCEMENT by Dow Chemical Co.[1] that vinyltoluene (meta and para methyl-styrene) appears to be a satisfactory substitute for styrene in the manufacture of some synthetic rubbers, plastics and coatings may take considerable load off the almost broken back of the benzene camel. It also may prove a useful outlet for hydroformer and reformer toluene, when and if the present demand for this material lets up.

Styrene for synthetic rubber, polystyrene and alkyd resins has been in very short supply for a considerable time, due in large part to the scarcity of benzene, principal starting material. Vinyltoluene on the other hand, comes from toluene and ethylene, and toluene, comparatively, is in much larger supply while it promises to become more so as authorized catalytic reforming units are completed and get going. Apparent joker is that there are three isomers of vinyltoluene (ortho, meta and para) and, since the Dow announcement ignores the ortho form, apparently it is not a satisfactory styrene substitute and must be removed, probably by distillation.

Vinyltoluene is reportedly better than styrene in the paint and varnish fields. Its polymerization rate is twice that of styrene and the vapor pressure is substantially lower. Although Dow doesn't say so, apparently vinyltoluene can be prepared in similar equipment to that now needed for styrene manufacture, since vinyltoluene is an alkylated product, followed by subsequent dehydrogenation.

The physical properties of vinyl toluene and a comparison of the polymerization characteristics with those of styrene are given in the table, below. Dow reports that handling and storage of this material is similar to that of styrene and the same concentration of p-tert.-butylcatechol (10 ppm.) is used as a polymerization inhibitor.

The short-term prospects for this new material are undoubtedly good, since it will serve to stretch available benzene supplies that much further. Whether or not it will affect the long-term demand for benzene, by substituting readily for it in the manufacture of synthetic rubber, is open to conjecture. In the light of present knowledge, however, one can safely speculate that there still will remain a good market for benzene in synthetic rubber and its other, well-known fields. The aromatics capacity now being installed and the potential outlets via motor fuels and other petrochemical possibilities will see to that. Then, too, there always is the strong possibility that new and expanded markets will develop for not only vinyltoluene, but styrene, benzene and synthetic rubber.

—D.P.T.

Characteristics of Vinyltoluene

% Total Unsaturation as vinyltoluene (Mercury Acetate Method)	98.8
Ref. Index at 25° C.	1.5393
Specific Gravity at 25/25° C.	0.8968
Flash Point (Cleveland Open Cup), °F.	140
Fire Point (Cleveland Open Cup), °F.	141
APHA Color No.	5
Absolute Viscosity, Cps. at 25° C.	0.770
Surface Tension at 25° C. (Dynes/cm.)	31.0
Freezing Point, °C.	—82.5

Initial Polym. Rate (First 10% Conversion): (3)

Polym. Temp. °C.	Vinyltoluene(3)	Styrene(3)
60	0.2%/hr.	0.11%/hr.
80	0.91	0.5
90	1.95	1.0
115	10.3	5.4

(1) Dilatometric method used—no inhibitors in monomers.
(2) 99.95% styrene purity, determined by freezing point.
(3) 99% vinyltoluene.

(1) "Vinyltoluene," by K. E. Coulter, J. Lawrence Amos, A. C. Wilcox, and F. J. Soderquist, unpublished technical paper released by Dow Chemical Co., June 8, 1951.

API Project 6 is Landmark In Oil Industry Research

RESEARCH Project No. 6 of the American Petroleum Institute has been on the boards for many years and yet current reports continually bring to light new developments in the work and show new applications of this fundamental research data in the applied research and development work of individual oil companies.[1]

This was one of the original API research projects launched in 1926, essentially to ascertain the major hydrocarbon constituents of one representative crude and later to learn how the amounts of the major components vary in different crudes. When the task was organized about all that was known of the composition of petroleum was that it consisted largely of hydrocarbons, but not more than 8 or 10 simple chain paraffin hydrocarbons had been separated and identified. The crude selected for the project was a 600-gallon batch from the Ponca City field in Oklahoma.

The work on Project 6 was carried out originally at the U. S. Bureau of Standards under Dr. E. W. Washburn and later under Dr. F. D. Rossini. When the latter recently became head of the Chemistry Department at Carnegie Institute of Technology in Pittsburgh, the work on Project 6 went with him.

The processes used in separating and identifying the individual hydrocarbons in the Ponca City field sample included distillation, extraction, adsorption and crystallization, and occasionally of necessity special methods. "Utilizing in appropriate combination and sequence the methods discussed above," the report brings out, "API Research Project 6 has separated by exhaustive fractionation from the gas, gasoline, kerosine and gas-oil fractions of the representative sample, 122 different hydrocarbons as of June 30, 1951."

Because of the greater complexity of the lubricant portions and lack of sufficient quantity of the material, the resolution of the lubricant fraction of the Ponca City crude was carried to the stage of homogeneous fractions, each containing molecules of the same size and type. As of two years ago this phase of the work had been carried to the point that

about 400 narrow cuts had been separated.

At an early date in Project 6 it was recognized that it was more difficult to separate and recover the individual hydrocarbons from the crude than to produce them by synthesis. This part of the work is carried on at Ohio State University, where more than 275 pure hydrocarbons have been prepared by synthesis. A practical aspect of this phase of Project 6 is the producing and making available to oil companies of pure hydrocarbon samples for spectrometer calibration and other research work. Another application of the work done in Project 6 is the development of a commercial silica gel adsorption method of separation recently announced by Sun Oil Co. The genesis of this method was in a laboratory technique developed by Dr. Rossini and his associates.[2]

The fundamental research data achieved through Project 6 has received world-wide attention and the details of the work have been published in some 140 technical papers. In addition there is now in preparation a book entitled "Hydrocarbons from Petroleum", in which the work will be summarized. It is doubtful if even the most enthusiastic sponsors of Project 6 could have foreseen the importance it would assume in fundamental petroleum research. —V.B.G.

(1) "Composition of Petroleum", by Frederick D. Rossini and Beveridge J. Mair; presented at the Symposium on "Twenty-five Years of Progress in Petroleum Technology" before the Division of Petroleum Chemistry of the American Chemical Society in New York, September, 1951.
(2) Aromatics by Adsorption", PETROLEUM PROCESSING, August, 1951, pg. 833.

You May Still Wear a Suit of Clothes Derived from Petroleum

SYNTHETIC fibers are becoming an important part of our domestic and business life. They are providing new and improved clothing, drapes, seat covers, screens, carpets, and tires. They also provide a host of jobs for chemical engineers."

To the last sentence of this opening paragraph of a recent survey of the synthetic fiber industry[1] might be added "and also a host of jobs for the petroleum industry's petrochemicals." Volume-wise and in comparison to the gigantic annual production of motor fuels and lubricants, petrochemical production is, of course, still rather small.

But, it is growing, and has been growing steadily for two or more decades. Total annual consumption of synthetic fibers, for example, was about 30,000,000 lbs. 25 years ago. Today it is well over a billion lbs. and still rising. Why?

"The textile industry now consumes about a quarter of all industrial chemicals sold," the same report[1] continues. "Every chemical engineer should look at the seeds of a revolution that have been planted in an old and conservative industry that until a few years ago thought that a few special items might be made from these 'imitation fibers' but they would never dig into the basic silk, cotton, and wool markets.

"First came the downfall of silk, helped in part by the shortage created by the war, completed by nylon's superiority.

"Then came higher wool prices. Scoured wool jumped from $1.63/lb. in March, 1950, to $3.75 in March, 1951. Result: new synthetic fibers are fast being woven into our economy.

"Rayon staple has been getting more popular and nylon staple also made a big hit with the public as it appeared on the market on a commercial scale after World War II."

So much for the already well-established and "on-the-way" fibers. Even greater potential usage is expected of the newer ones: du Pont's Orlon, a polyacrylonitrile, made from acrylonitrile, in turn from ethylene oxide and HCN. Production is expected to hit 200,000,000 lbs./year in the 1950's. That's as big as nylon production. Then there's Carbide & Carbon's dynel, a blending of acrylonitrile with vinyl chloride. And there's Dacron, a condensation product of dimethyl terephthalate and ethylene glycol.

Prices today on these fibers are still relatively high but nevertheless competitive with wool prices. And don't overlook the fact that for the fifth consecutive year, world consumption of wool has *exceeded* production. —W.C.U.

(1) "Synthetic Fibers," *Chemical Engineering*, August, 1951, pp. 125-132.

Will Phenol from Cumene Be Next Petrochemical?

REFINERS who made cumene for wartime use in avgas and those who now are installing catalytic reforming processes wherein aromatics will be produced, might take a close look at the possibilities for phenol production.

By this is not meant the conventional method involving chlorination or other routes. Rather, they might consider something based on the process to be used in the new B.A.-Shawinigan Ltd. chemical plant, [1, 2] whereby *benzene* is alkylated with propylene to produce *cumene*. Thence the cumene is oxidized with air in an inert solvent or an emulsion with soaps to the hydroperoxide and subsequently decomposed by boiling with an acid catalyst (such as sulfuric, acetic, etc.) into phenol and acetone.

Cumene was produced during the late war in numerous refineries by charging benzene and propylene to their catalytic polymerization units, using phosphoric acid or copper pyrophosphate as catalyst. Since those days, many more plants have installed poly units and there are numerous reformers in use and under construction. Not a few refiners have announced intentions of recovering benzene, toluene and xylenes from the aromatics-rich reformate.

As is well known, phenol has many uses in its own right as well as in plastics and as a chemical intermediate. Acetone is in wide demand as a solvent. While benzene is currently in short demand this condition is not expected to persist. Besides, conversion to phenol and acetone will offer another outlet for a refiner's aromatics production when and if the quasi-wartime demand now prevailing shows signs of tapering off, and should the output of high octane gasolines not absorb all of his production.

There are two principal advantages to the new process for refiners to consider in making use of their wartime experience. First, it offers a rather simple opportunity to enter the chemical market either via the route of the complete synthesis or in supplying benzene or cumene as intermediates without addition of new units to furnish the raw materials. Second, it gets away from the problems of chlorination if the complete synthesis proves attractive. —D.P.T.

(1) "What's Happening," PETROLEUM PROCESSING, Vol. 6, No. 7, p. 601, July, 1951.
(2) "Now, Phenol from Cumene," *Chemical Week*, Vol. 69, No. 8, p. 23, Aug. 25, 1951.

SANTOLUBE 394-C
(Typical Inspection Values)

Specific Gravity at 60° /60° F.	1.02
Viscosity S.U.S. at 210° F.	90
S.U.S. at 100° F.	2850
Flash Point °F.	200
Color ASTM (diluted)	3
% Phosphorus	4.7
% Sulfur	13.0

SANTOLUBE 395-X
(Typical Inspection Values)

Specific Gravity at 60° /60° F.	1.01
Viscosity S.U.S. at 210° F.	85
S.U.S. at 100° F.	1675
Flash Point °F.	230
Color ASTM (diluted)	5
% Phosphorus	3.8
% Sulfur	10.7
% Barium	1.0

New look for old bearings

Santolube 394-C and Santolube 395-X are Monsanto's corrosion inhibitors and anti-oxidants which, added to suitable base stocks, produce motor oils that protect hard alloy bearings and keep them looking like new.

These additives improve lubricant stability and engine performance by minimizing lubricant oxidation, acid formation and sludge and varnish deposits, and by inhibiting bearing corrosion and lubricant thickening.

SANTOLUBE 394-C, with suitable base oils, may be used alone to compound premium-type lubricants, or it may be combined with detergent-dispersant additives, such as Santolubes 203-A, 303-A and 520, in proper oils, to get "Premium," "Medium Duty" and "Heavy Duty" lubricants.

SANTOLUBE 395-X was designed primarily for compounding "Premium" motor oils. It also may be used in combination with detergent-dispersant additives to make "Medium Duty" and "Heavy Duty" oils.

Both additives can be blended by using conventional equipment and methods. For further information, write MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

MONSANTO PETROLEUM ADDITIVES

Pour-point depressants
SANTOPOUR*
SANTOPOUR B

Motor-oil inhibitors
SANTOLUBE* 395-X, 394-C

Viscosity-index improver
SANTODEX*

Gear-lubricant additive to meet requirements of Federal specification VV-L-761
SANTOPOID* 5

Gear-lubricant additives to meet requirements of military specification MIL-L-2105
SANTOPOID 29, 32, 33

Motor-oil detergents
SANTOLUBE 203-A, 303-A, 520

Corrosion inhibitor for distillate fuels
SANTOLENE* C

Sludge inhibitor for domestic fuel oils
SANTOLENE E

Cutting-oil additive
SANTOLUBE 52

Inhibitor-detergent combinations for premium and heavy-duty service
SANTOLUBE 205, 206, 360, 374, 379, 388, 521, 522

URGENT—Please round up tank cars, carboys and returnable drums and send them back to your chemical supplier. Containers are extremely short.

*Reg. U. S. Pat. Off.

MONSANTO
CHEMICALS—PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

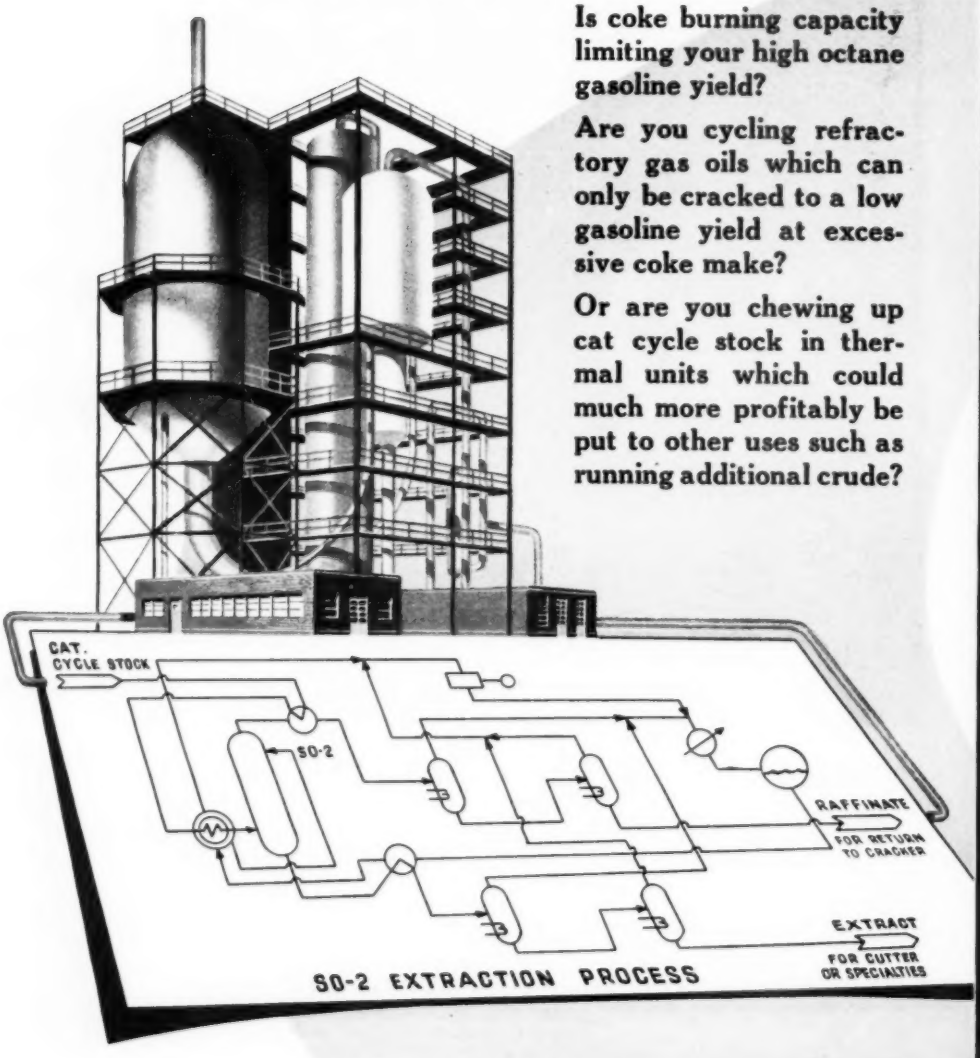
(To obtain more data on advertised products see page 1028)

"TEACH YOUR OLD

Is coke burning capacity limiting your high octane gasoline yield?

Are you cycling refractory gas oils which can only be cracked to a low gasoline yield at excessive coke make?

Or are you chewing up cat cycle stock in thermal units which could much more profitably be put to other uses such as running additional crude?



CAT NEW TRICKS"

INVESTIGATE SO_2 EXTRACTION OF CATALYTIC CYCLE STOCKS

This process will give high yields of raffinates which crack as well or better than virgin gas oil. The extraction operation removes sulfur and heavy aromatics, and the resulting raffinate will give a high gasoline yield, with frequently less coke than your fresh feed. This reduced coke make may permit recycling to extinction in your existing catalytic unit.

The extracts are highly aromatic, of low viscosity, and can be worked up into specialties or used for the viscosity cutting of heavy residuals. Depending upon your local utility balance, direct operating costs . . . utilities, labor, maintenance and solvent . . . may be less than 5c a barrel.

SO_2 extraction has been proved by many years of dependable operating experience. The solvent is cheap, universally available, and because of its low boiling point, product contamination and solvent recovery present no problems. Furthermore, an SO_2 plant is adaptable to running all types of stocks from light naphthas to heavy gas oils.

Let us give you more information about this versatile refinery tool.

BADGER PROCESS DIVISION
OF STONE & WEBSTER ENGINEERING CORPORATION

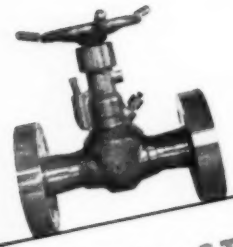
BOSTON NEW YORK
LONDON E. B. Badger & Sons (Great Britian) Ltd.

Process Engineers and Constructors for the Petroleum, Chemical and Petro-Chemical Industries

 (To obtain more data on advertised products see page 1028)

ORBIT VALVES®

Cut Valve Maintenance Costs with ORBIT



FORGED STEEL PRODUCTION VALVES L. P. GAS VALVES

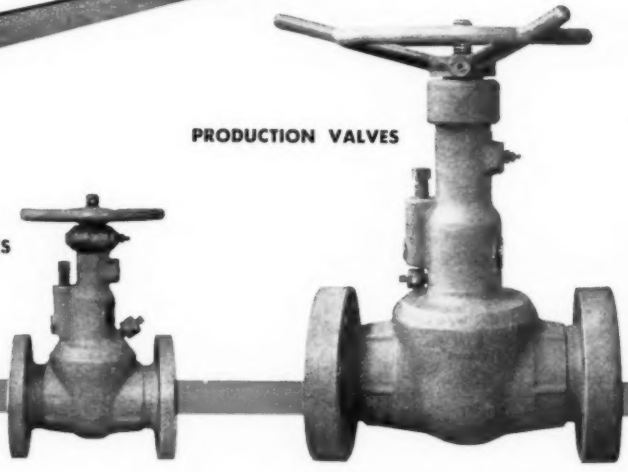
ORBIT FORGED STEEL VALVES have set new standards of efficiency, simplicity and compactness in valve design. The Orbit Friction Free Seating Principle requires no lubrication of the sealing surfaces to effect a positive shutoff.

After installation ORBIT FORGED STEEL VALVES require infrequent attention because only nominal amounts of lubricant is required for the Stem mechanism.

ADJUSTABLE PLASTIC STEM PACKING is employed which is effective and permanent. This packing will seldom, if ever, need adjusting after the valve goes into service.

PRODUCTION VALVES

L. P. GAS VALVES



BRANCHES

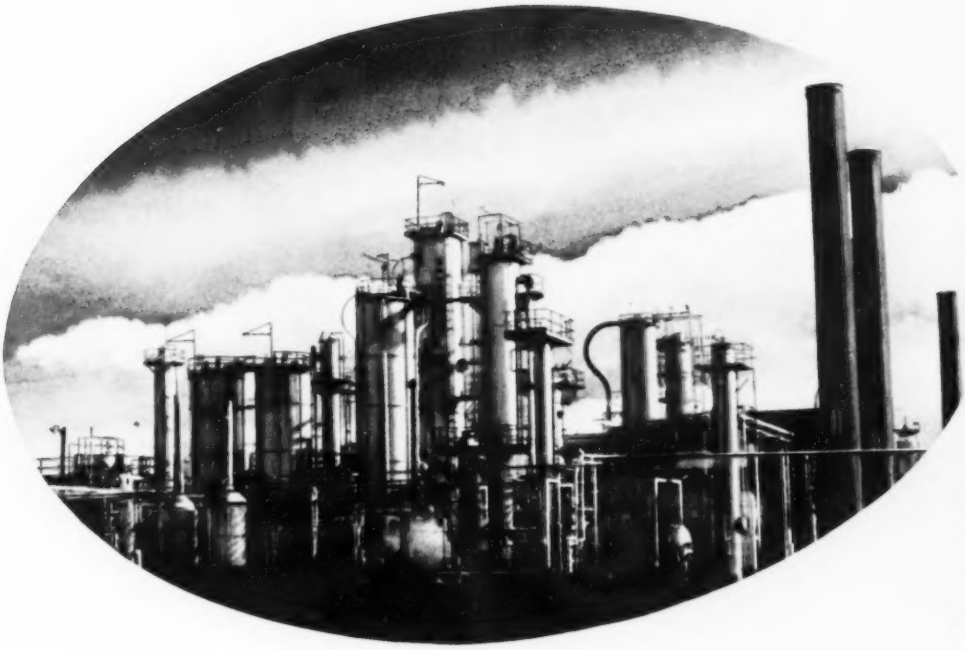
HOUSTON, TEXAS
407 Velasco
(serving the Gulf Coast)
ODESSA, TEXAS
Starr Warehouse
(serving West Texas area)
CASPER, WYOMING
The Great Western Company
(serving the Rocky Mountains and Canada)

Your Supply Store Carries Orbit Valves in Stock

ORBIT VALVE COMPANY

P. O. BOX 699 TULSA, OKLAHOMA

YOU CAN DEPEND ON *Full* PRODUCTION



...WITH *Continental* SERVICE!

Maintenance men in the refining and petrochemical industries know that Continental's 72 stores and offices . . . Continental's complete stocks, fast delivery and high quality . . . all help them to maintain capacity production, *all* the time!

Construction engineers and superintendents know that these same *plus-factors* help them avoid needless "shorts" at the job. Continental's ready *all* the time . . . to help make their time more valuable.

In these times, Continental's services are prepared to meet your specific requirements, and to help you avoid costly delays!

Call or visit your nearest Continental store or office—today!

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION MEMBER

CONTINENTAL

SERVING THE OIL AND GAS INDUSTRIES

THE CONTINENTAL SUPPLY COMPANY, *General Offices*: DALLAS, TEXAS

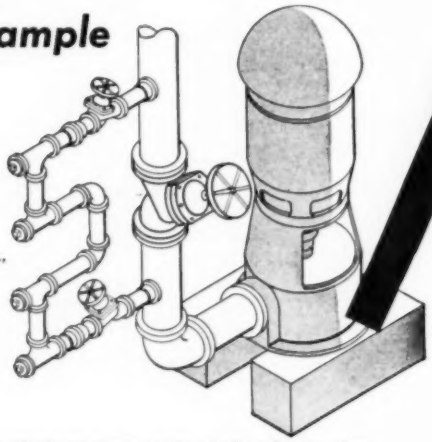
***Export Division*: The Continental Supply Co., Inc., 30 Rockefeller Plaza, New York, N. Y.**
The Continental Supply Company, Limited, 216 Lancaster Building, Calgary, Alberta

Representatives: ARGENTINA • BOLIVIA • BRAZIL • CHILE • COLOMBIA • ENGLAND • ECUADOR • PERU • TRINIDAD • URUGUAY • VENEZUELA

for outstanding service

on Corrosive Well Water

...for example



The Installation—
Barr Rubber Products Co.,
Sandusky, Ohio

PROBLEM: To eliminate costly seating and packing maintenance, and frequent replacement of valves on plant well-water pump. Valves previously used highly unsatisfactory, having maximum life of 6 months.

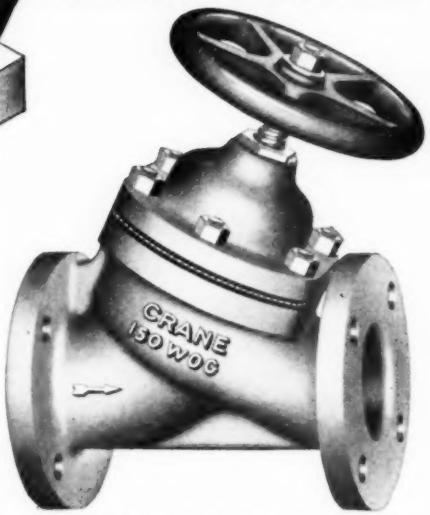
WORKING CONDITIONS: Sulphur content of water extremely high. Valve constantly exposed to severe corrosive and erosive effects. Operated infrequently; yet easy operation, positive seating are prime requisites.

SOLUTION TO PROBLEM: Crane Packless Iron Body Diaphragm Valves featuring separate disc and diaphragm design. Three-inch No. 1611 flanged end valve on main discharge; ¼-inch No. 1610 screwed end valves on by-pass.

RESULT: While other valves lasted only 6 months or less, Crane Diaphragm Valves show no effects of service, after more than a year. They operate smoothly . . . seat tightly . . . no maintenance whatsoever needed to date!

Another typical demonstration of superior quality, and the low-cost performance of Crane Valves. That's why . . . More CRANE VALVES are used than any other make!

...Choose Dependable CRANE VALVES



No. 1611 Crane Iron Body Diaphragm Valve —one of a full line suited for many services. Literature on request from your Crane Branch or Crane Wholesaler.

CRANE CO.

General Offices:
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

(*To obtain more data on advertised products see page* 1028)

better measurement and control of

LIQUID LEVEL

In the measurement or control of liquid level — whether your problem involves turbulent, viscous or corrosive liquids, open tanks or closed pressure vessels — Foxboro offers complete diversity of premium-quality instruments to meet the requirements . . . and unmatched application experience to guide specification or design of the most efficient system for your operation.

INDICATORS • RECORDERS • CONTROLLERS
diaphragm, bubble tube, float, and differential pressure measuring systems for open or closed vessels
PNEUMATIC OR ELECTRONIC TRANSMISSION
• CONTROLLED VALVES

FOXBORO
Reg. U. S. Pat. Off.

For over 40 years, specialists in the measurement and control of temperature, pressure, flow, liquid level, humidity . . .

THE FOXBORO COMPANY • FOXBORO, MASSACHUSETTS, U.S.A.

There's a PETRO-CHEM ISO-FLOW *furnace* .....

for every fluid heating service, capacity or duty, irrespective of temperature pressure range.

for REFINERIES

crude distillation, vacuum distillation, thermal cracking, catalytic cracking, thermal reforming, catalytic desulphurization, catalytic reforming, solvent refining, isomerization

for RECYCLING PLANTS

catalysis heaters with catalyst in tubes, steam superheating to 1500° F, gas cracking, reactant distillation, direct fired reboiling

for CHEMICAL PLANTS

rich oil distillation, secondary fractionation, depropanizing, debutinizing, reboiling heat medium

for GAS PLANTS

at individual leases and for main line dehydration for catalyst regeneration—up to 500,000,000 cubic feet per day, unlimited pressure

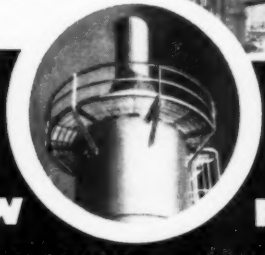
for PIPELINES

gas dehydration, gas and air superheating for turbine drives, reduction of viscosity of oil in long transmission lines

for ASPHALT PLANTS

including tank heating, loading heaters, manufacture of linoleum, roofing and tile—circulating heaters for saturates

Throughout the world, in the petroleum, chemical and allied industries, there are more than 800 Petro-Chem Iso-Flow Furnaces performing to the complete satisfaction of their operators and generally well in excess of their rated capacities.



PETRO-CHEM ISO-FLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

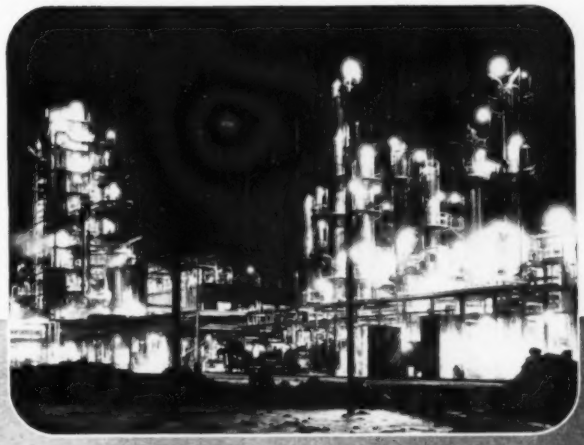
PETRO-CHEM DEVELOPMENT CO., INC., 120 EAST 41ST STREET, NEW YORK 17, N.Y.

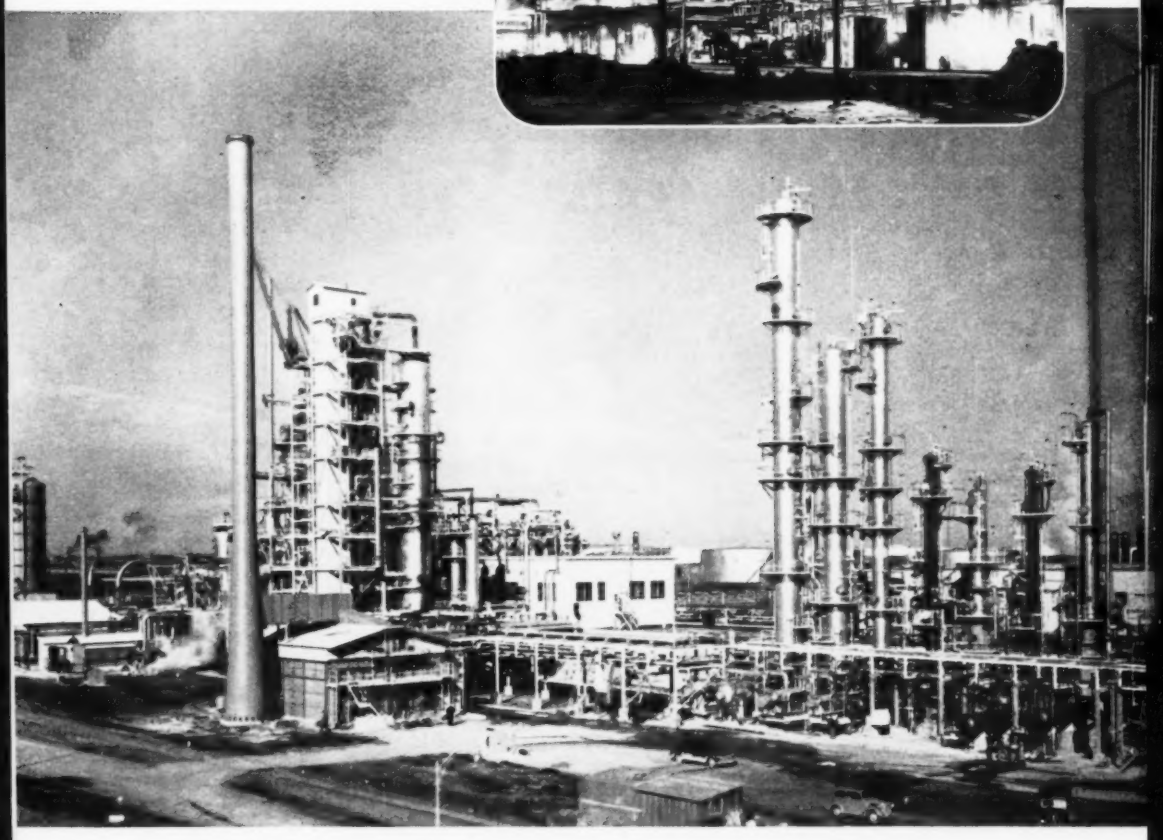
REPRESENTATIVES

Bethlehem Supply, Tulsa and Houston • Flagg, Brackett & Durgin, Boston • D. D. Foster, Pittsburgh
Faville-Levally, Chicago • Lester Oberholtz, California • Gordon D. Hardin, Louisville, Kentucky

NEW CAT CRACKER BY McKEE

● Engineering and construction of this compact new Catalytic Cracker and its integrated facilities were recently completed by Arthur G. McKee & Company for Shell Oil Company of Canada, Limited.





DESIGN, ENGINEERING AND CONSTRUCTION FOR THE PETROLEUM REFINING AND IRON AND STEEL INDUSTRIES

McKee Engineering

Arthur G. McKee & Company · Established 1905

Headquarters: McKee Building, 2300 Chester Avenue, Cleveland 1, Ohio. *New York:* 30 Rockefeller Plaza, New York 20, N.Y. *Tulsa:* 918 First National Bank Building, Tulsa 3, Okla. *England:* The Iron and Steel Division of Arthur G. McKee & Company, is represented by Head, Wrightson & Co., Ltd.

TYLER . . . THE
ROSE CAPITAL OF THE WORLD

NOW HAS ANOTHER NEW PLANT . . .

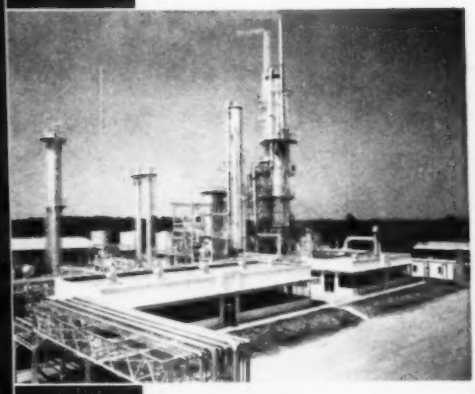
TRECO DOES IT AGAIN!

The McMurrey Refinery has many outstanding features that are worthy of the consideration of anyone contemplating new plant construction. Refinery Engineering Company will supply complete details.

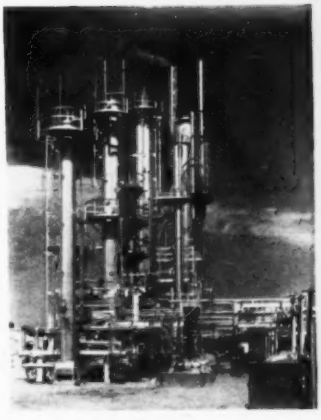
1. **EARLY COMPLETION DATE**
   Plant was "on stream" in less than a year after the contract was signed.
2. **LOW LABOR COST**
   Total field construction labor was appreciably under the estimate of the cost of the project.
3. **SAFETY AND EFFICIENCY**
   Every known safety and efficiency feature, with respect to ease of operation, was kept in mind throughout the design and construction of the plant.
4. **SPEED OF OPERATION**
   The complete unit, including the Poly plant, was placed "on stream" in less than 24 hours after starting the raw oil charge pumps.

Confirmation of the above may be had by placing a telephone call to Mr. M. H. McMurrey, President, McMurrey Refining Company, Tyler, Texas.

NEW McMURREY REFINERY, TYLER, TEXAS



Mr. M. H. McMurrey, President, McMurrey Refining Company, is a well-known East Texas Industrialist and Rancher. The progressive thinking and planning of Mr. McMurrey and the splendid cooperation of his staff made possible the completion of this refinery in record time.

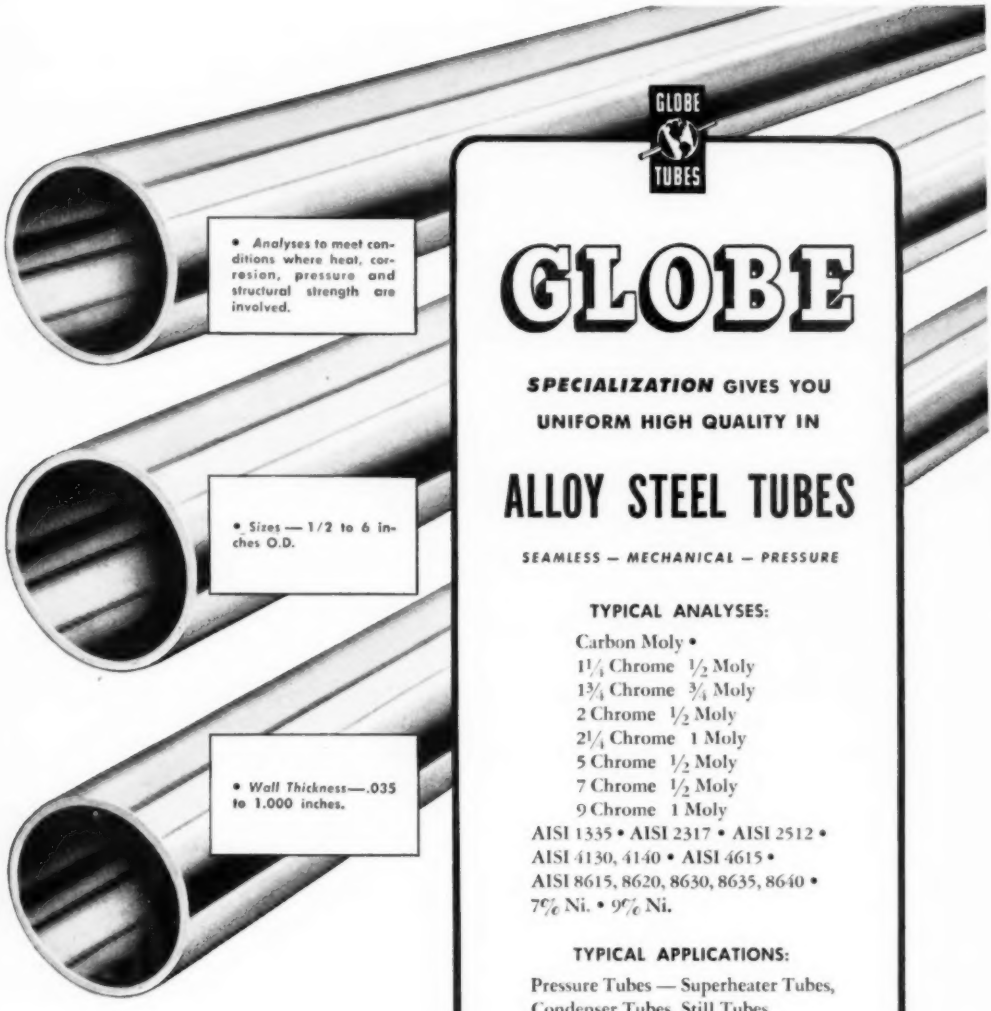


TRECo

Call, wire or write for a discussion of your refining problems and their solution, without obligation. Our airplanes make us neighbors.

REFINERY ENGINEERING Company

PHONE 5-5561 • TULSA, OKLAHOMA


• Analyses to meet conditions where heat, corrosion, pressure and structural strength are involved.
• Sizes — 1/2 to 6 inches O.D.
• Wall Thickness—.035 to 1.000 inches.

GLOBE TUBES

GLOBE

SPECIALIZATION GIVES YOU UNIFORM HIGH QUALITY IN

ALLOY STEEL TUBES

SEAMLESS — MECHANICAL — PRESSURE

TYPICAL ANALYSES:

Carbon Moly •
1¼ Chrome ½ Moly
1¾ Chrome ¾ Moly
2 Chrome ½ Moly
2¼ Chrome 1 Moly
5 Chrome ½ Moly
7 Chrome ½ Moly
9 Chrome 1 Moly
AISI 1335 • AISI 2317 • AISI 2512 • AISI 4130, 4140 • AISI 4615 • AISI 8615, 8620, 8630, 8635, 8640 • 7% Ni. • 9% Ni.

TYPICAL APPLICATIONS:

Pressure Tubes — Superheater Tubes, Condenser Tubes, Still Tubes, Evaporator Tubes • Barrel Tubes • Oil-Well Pump Barrels • Mechanical Tubes • Aircraft Tubes • Propeller Tubes • Rollers for Transmission Chains

Globe engineers gladly give you the benefit of specialized knowledge and experience on the application of steel tubing in a wide range of services — mechanical — pressure — corrosion resistant.

When you specify Globe, you are sure of uniform high quality alloy steel tubes — the product of highly developed production facilities and specialized quality controls. Globe Tubes are thoroughly inspected and closely held within tolerance specifications. Write for the Globe general catalog.

Globe Steel Tubes Co., Milwaukee 46, Wis.
Chicago • Cleveland • Detroit • New York • Philadelphia
St. Louis • Houston • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron (high-purity ingot iron) seamless tubes — Globe Welding Fittings.

HARDESTY PRODUCTS

ARE INDUSTRY'S KEYSTONE

25 years young

AND GROWING FASTER THAN EVER

HARDESTY FATTY ACIDS

Red Oil
•
Stearic Acid
•
Hydrogenated Fatty Acids
•
Animal and Vegetable Fatty Acids
•
Glycerine
•
White Oleine
•
Stearine Pitch

W. C. Hardesty Co., Inc., for 25 years a dependable source of quality products, is now reinforced by the extensive research facilities of Novadel-Agene Corporation and its affiliate, Wallace & Tiernan Co., Inc.

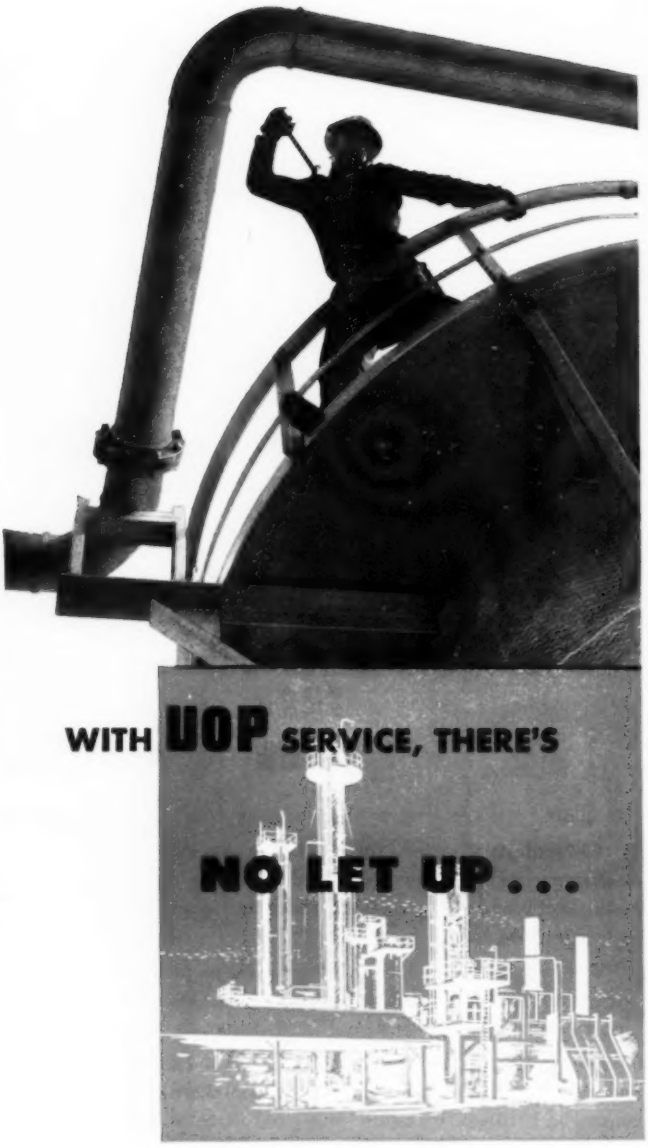
With expanded production programs at its two plants and a larger technical field staff, W. C. Hardesty Co., Inc. is better equipped than ever to serve your needs promptly and precisely.

Look to W. C. Hardesty Co., Inc. for new developments in Fatty Acid Chemistry and for continued high standards of quality control to help you maintain your production at uniform top-quality levels.

W. C. HARDESTY CO., INC.

41 EAST 42ND STREET, NEW YORK 17, N.Y.
PLANT: DOVER, OHIO

W. C. HARDESTY CO. OF CANADA, LTD., *TORONTO, CANADA*



CANADIAN OIL'S NEW 20,000 B/D REFINERY IS INSTALLING 4,000 B/D PLATFORMING UNIT

By E. A. Smith
Manager of Manufacturing
Canadian Oil Companies, Ltd.

Early in 1952 Canadian Oil Refineries, Ltd., a wholly-owned subsidiary of Canadian Oil Companies, Ltd., will have completed and placed into operation at Froomfield, Ontario, just four miles south of Sarnia, a completely new $18,000,000 refinery. This modern plant will contain processing facilities which represent the finest in advanced petroleum refining techniques.

E. A. Smith

The major processing elements which are being erected in the new refinery are:

(a) 20,000 barrel per day atmospheric and vacuum distillation unit, with vis-breaking;

(b) 10,000 barrel per day orthoflow catalytic cracking unit, gas concentration system, and UOP catalytic polymerization unit;

(c) 4,000 barrel per day UOP Platforming Unit.

Plant storage will be upwards of 2,000,000 barrels.

The decision which prompted construction of the Froomfield refinery was influenced in major part by the following factors:

1. The growing inadequacy of our 4,000 b/d refinery at Petrolia, which has been in continuous operation since its origin in 1900 and is nearing obsolescence, to meet the increasing requirements for more and higher quality petroleum products.
2. The complexity of the crude oil supply situation. During the early years, Petrolia refinery had been dependent on the Petrolia-Oil Springs field which rapidly diminished in production. Mostly we have been dependent on the U.S. for supplies. It is interesting to note that although the once rich Petrolia-Oil Springs fields were discovered almost simultaneously with discovery of the Pennsylvania field in 1859, they are still in active, although meagre, production.
3. The location in Sarnia and close coordination of the Froomfield project with that of the great Polymer Corporation, a Canadian Government company, which requires large quantities of refinery ingredients for use in the manufacture of synthetic rubber. Polymer is considered to be one of the world's finest completely integrated plants. It is also the only synthetic rubber plant built and operating in the British Empire.

(To obtain more data on advertised products see page 1028)

4. Access to an adequate and assured supply of Canadian crude oil from the Alberta fields. Redwater crude for the new Froomfield refinery will be delivered by the Interprovincial Pipe Line from Edmonton to Superior, Wis. Tankers will then transport the crude to refinery storage.

Our Froomfield plant will tie in operations with that of the Polymer Corporation and another large chemical organization as follows: Canadian Oil will supply them with a butylene stream and a tail gas stream of C_2 and lighter, from which they will extract ethylene and ethane and crack the ethane into ethylene. An LPG stream of propane will be supplied, which also will be cracked into ethylene. The propylene incident to the pyrolysis of ethane and propane will be returned to Froomfield for polymerization, along with our own propylene stream. This will thereby make up, in large measure, the deficit of poly gasoline occasioned by the release of butylenes to Polymer.

The selection of the UOP Platforming process for Froomfield was made after our engineers had completed studies of the various reforming processes now in operation and some of which were still in the pilot plant stage. We supplemented our studies on Platforming by journeying to Muskegon, Michigan, to witness at first-hand the commercial operation and performance of the Old Dutch Refining Company Platformer, the first industrial or full-scale unit built.

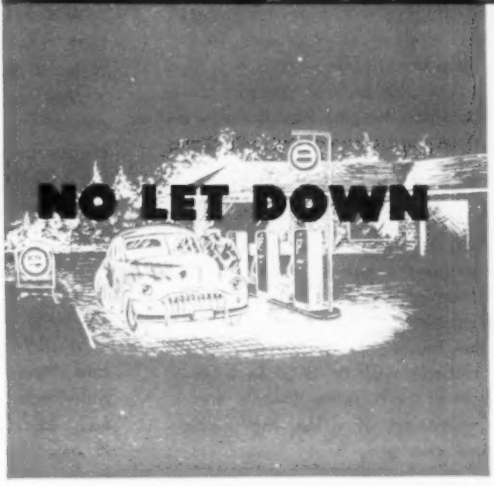
We were convinced, after carefully weighing all of the factors involved, that for our particular operation Platforming was indeed the superior reforming process.

The guaranteed charging capacity of the Platformer is 3800 b/sd. Engineering and construction of the unit is under the direction of Procon Incorporated.

At the present time provisions are being made to charge a stream of 250°-400° F. straight run naphtha to the Platformer. We estimate that 60% of the Platformate which is realized from this operation will be available, for defense purposes, as aviation gasoline base stock. Consideration also is being given to providing a narrow cut of light straight run as charge to the Platformer for the production of benzene, which is in short supply. This will particularly be the practice when the Government requires portions of the 250°-400° F. naphtha for aviation jet fuel.

In designing the refinery, full cognizance was given to Canada's great defense effort, in which our operations at Froomfield are destined to play a prominent part.

Canadian Oil Companies, Ltd. is, and Canadian Oil Refineries will be, completely owned, staffed and operated by Canadian personnel. Refinery products are marketed through an organizational distribution set-up that extends from the Atlantic to the Rockies. The products are marketed under the trade name of "White Rose." The home office of Canadian Oil is located at 204 Richmond Street, West, Toronto, Ontario.



UNIVERSAL OIL PRODUCTS COMPANY

General Offices: 310 S. MICHIGAN AVE., CHICAGO 4, ILL., U.S.A.

Laboratories: RIVERSIDE, ILLINOIS

Universal Service Protects Your Refinery

(To obtain more data on advertised products see page 1028)

Attention!

OPERATORS OF CONDENSERS

Instead of retubing with plain tube, install finned tube. We mean Wolverine Trufin* —the integral finned tube—which will give you many times the surface area of plain tube in the same length; thus greatly increasing your capacity without increasing space. You'll gain extra production and improve your efficiency. Vital considerations today.

Moreover, the surface area thus obtained through the use of Trufin affects further economies in producing most petroleum condensates.

Since the fins of Trufin are extruded from the outside wall of a plain tube—hence a part of the tube itself—this unique tube will withstand vibration and sudden temperature changes.

And quite important, too, is the fact that retubing and "shut down" time is reduced appreciably.

Add all these advantages that Trufin offers you—space saving, capacity increase, production gain, improved operating efficiency, lowered maintenance cost, less "shut down" time, and many more—you can recognize the wisdom of specifying Wolverine Trufin for your next retubing job.

Conserve metal, men, and machines.

WOLVERINE TUBE DIVISION, Calumet and Hecla Consolidated Copper Company, Incorporated, *Manufacturers of seamless, non-ferrous tubing,* 1425 Central Avenue, Detroit 9, Michigan.

*Reg. U.S. Pat. Off.

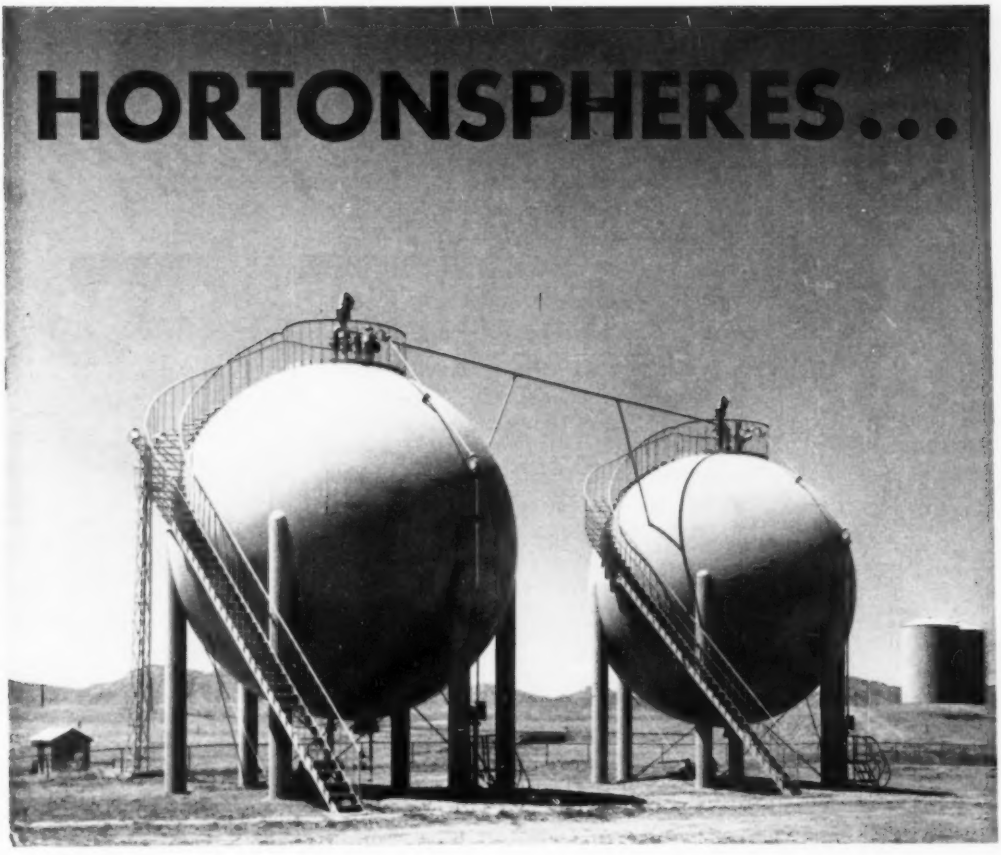
Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ont.

Wolverine Condenser Tubes stocked by Butler Industries, Inc., 355 South Fourth Street, Beaumont, Texas. Tel.: Beaumont 5-2351.

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA
Sales Offices in Principal Cities

Export Department, 13 E. 40th St., New York 16, N. Y.

HORTONSPHERES...



Don't Let Profits Disappear into Thin Air

During 1948, the California Company completed a recovery plant for processing natural gas from the Rangely, Colorado, field. The two 2,000-bbl. Hortonspheres shown above are used to store natural gasoline produced at the plant.

Pressure storage of natural gasoline in Hortonspheres prevents the excessive losses that occur from storage in atmospheric pressure tanks. Hortonspheres don't vent the light fractions that give natural gasoline most of its value as an ingredient of blended motor fuel. They also prevent the accumulation of explosive or toxic vapors in the storage area.

Hortonspheres are economical to build because every pound of metal used in the construction of the shell directly resists internal pressure. They cost less to paint and maintain because they have less surface area per barrel of capacity than containers of any other shape.

For more complete information about Hortonspheres, Hortonspheroids, Hortondome Roofs, Hemispheroids, or any other efficient Horton vapor-saving structure, write our nearest office. Our experienced staff of engineers, fabricators and erection crews are always ready to provide you with finer storage facilities.

CHICAGO BRIDGE & IRON COMPANY

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

Atlanta 3 — 2103 Healey Building
Birmingham 1 — 1527 North Fiftieth Street
Boston 10 — 1029–201 Devonshire Street
Chicago 4 — 2114 McCormick Building
Cleveland 15 — 2215 Guildhall Building
Detroit 26 — 1532 Lafayette Building
Houston 2 — 2130 National Standard Building
Los Angeles 17 — 1526 General Petroleum Building
New York 6 — 3310–165 Broadway Building
Philadelphia 3 — 1630–1700 Walnut St. Building
Salt Lake City 4 — 530 West 17th South Street
San Francisco 4 — 1539–200 Bush Street
Seattle 1 — 1330 Henry Building
Tulsa 3 — 1620 Hunt Building
Washington 6, D. C. — 1135 Cafritz Building

REPRESENTATIVES AND LICENSEES

Horton Steel Works, Fort Erie, Ontario, Canada
Ateliers et Chantiers de la Seine Maritime, Paris, France
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Chicago Bridge & Iron Company, Ltd., Apartado 1348 Caracas, Venezuela
Compagnia Tecnica Industrie Petroli, Rome, Italy
Wheatsoe Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Comarimo N. V., Amsterdam-O, Netherlands
Sociedade Chibridge de Construcoes Ltda., Av. Franklin Roosevelt, 194–S704-C Rio de Janeiro, Brazil

Don't let corrosive media *eat away your profits!*

We know that to have production in the Chemicals or Process Industries you must have corrosive media. We also know that "down time" caused by corroded valves slows up production and therefore "eats away" your profits.

But why worry? Powell makes valves of the *right* materials to resist the action of every known form of corrosive media encountered in these industries.

Gate, Check, Globe and Y Valves, in Bronze, Iron, Steel and Corrosion-Resisting Metals and Alloys

★

Quality fine throughout "The Line"

★

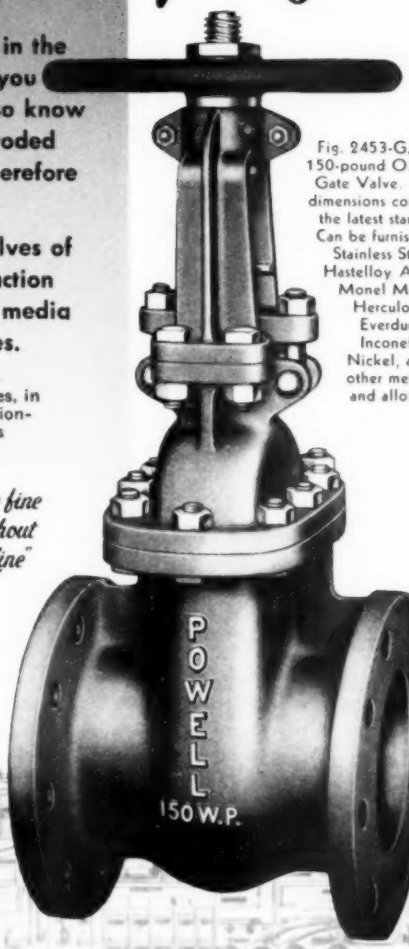
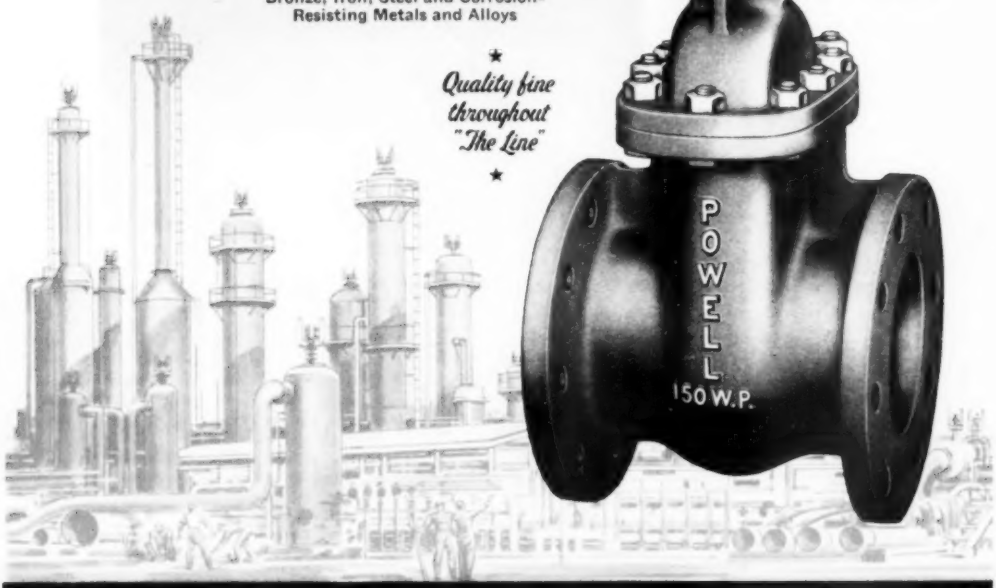


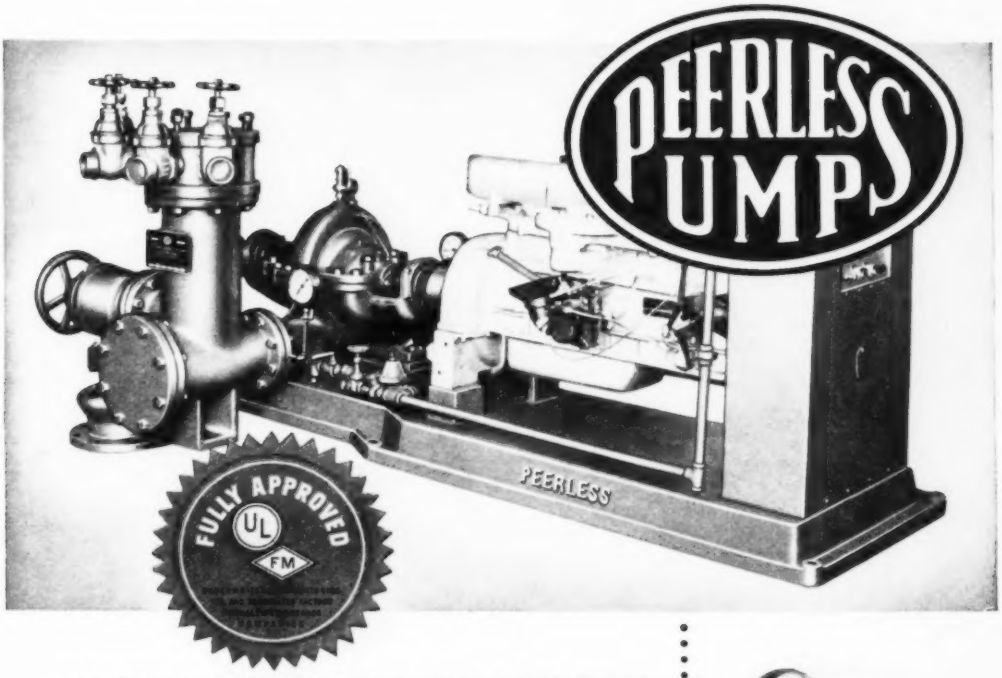
Fig. 2453-G. Large 150-pound O. S. & Y. Gate Valve. All the dimensions conform to the latest standards. Can be furnished in: Stainless Steels, Hastelloy Alloys, Monel Metal, Herculoy, Everdur, Inconel, Nickel, and other metals and alloys.



POWELL

The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio

FOR UNSURPASSED FIRE PROTECTION PUMPS LOOK TO THE LEADER—LOOK TO PEERLESS



PEERLESS UNDERWRITERS' APPROVED FIRE PUMPS (DAYTON-DOWD DESIGN)

HORIZONTAL CENTRIFUGAL AND VERTICAL TURBINE TYPES—Peerless Underwriters' Approved Fire Pumps can be applied to practically every commercial and industrial risk requiring fire protection. They afford dependable, low cost protection, peak quality performance and unquestioned reliability that often will result in measurable savings in insurance cost.

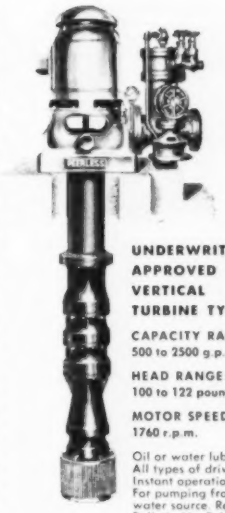
SINGLE AND MULTI-STAGE—Peerless Underwriters' Approved Fire Pumps are available in two types. The Type AF, shown above, is a single stage, double suction, horizontal centrifugal design, with a capacity range of from 500 to 2000 g.p.m., affording pressures, at rated capacities, from 40 to 150 lbs. and is available in 4", 5", 6" and 8" discharge sizes.

The Type TUF is a 2-stage pump available in 4", 5", 6" or 8" discharge sizes and furnishes from 500 to 1500 g.p.m., with a pressure range, at rated capacities, from 100 to 200 lbs.

ALL TYPES OF APPROVED DRIVES—Peerless approved fire pumps may be equipped with any type of drive: electric, steam turbine, gasoline or diesel engine. Auxiliary stand-by engine drives may be used in conjunction with turbine or motor drive to assure instant service even in the event of power failure.

SPRINKLER AND FOAM SYSTEMS—Peerless Underwriters' Approved Fire Pumps are ideal for application to liquid-foam type fire protection systems as well as to conventional sprinkler application; the former is especially desirable for solvent processing plant protection where the split-second control of fire hazards is a must.

NEW 24-PAGE BULLETIN ANSWERS ALL QUESTIONS ON UNDERWRITERS' FIRE PUMPS—Peerless Bulletin No. B-1500 completely describes and illustrates these unsurpassed and approved fire protection pumps. Write for your free copy today.



UNDERWRITERS' APPROVED VERTICAL TURBINE TYPES

CAPACITY RANGE: 500 to 2500 g.p.m.

HEAD RANGE: 100 to 122 pounds.

MOTOR SPEEDS: 1760 r.p.m.

Oil or water lubricated. All types of drives. Instant operation. For pumping from any water source. Request Bulletin No. B-152-1.

PEERLESS PUMPS fmc

PEERLESS PUMP DIVISION

FOOD MACHINERY AND CHEMICAL CORPORATION

Address Inquiries to Factories at: Los Angeles 31, Calif. or Indianapolis 8, Indiana

Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix; Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico

(To obtain more data on advertised products see page 1028)

ALCOA

Alcoa Heat Exchanger News

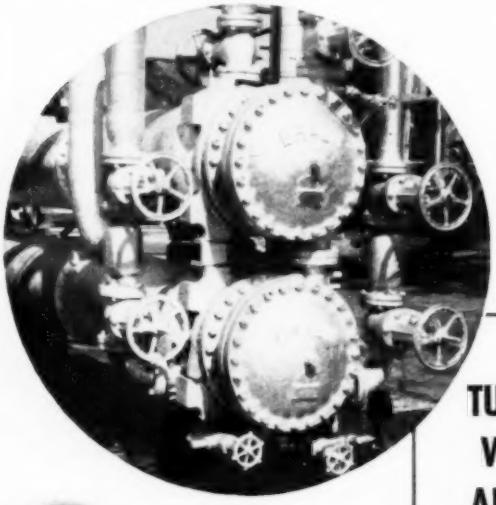
Published by Aluminum Company of America

Rearmament needs severely limit the manufacture of aluminum heat exchanger tubes. But we realize that the purchase of refinery and processing equipment requires long study of economic and performance factors. That is the reason for this message.

ALUMINUM TUBES SAVE THOUSANDS IN COST OF FURFURAL EXCHANGERS

. . . stay free of deposit, cut maintenance and down time

The furfural extraction process for lube oil presents some interesting heat exchanger problems. Copper, acting as a catalyst, polymerizes the furfural. The resulting hard, tenacious deposit requires frequent cleaning.



Then three years ago a large west coast refinery decided to try Alcoa Aluminum Tubes in their furfural exchangers. After several months operation, advantages of aluminum tubes became apparent. ALUMINUM REMAINS COMPLETELY FREE OF FOULING IN FURFURAL SERVICE. Aluminum tubes in furfural service do not require cleaning. In addition to the thousands of dollars saved in original cost, aluminum saves several thousand more each year in reduced maintenance and down time.

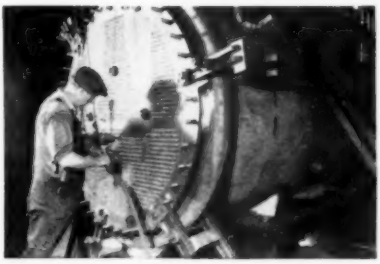
Aluminum tubes are ideal for hundreds of chemical and petroleum applications, and Alclad 3S-H14 tubes are ideal where fresh, salt, or brackish cooling waters are encountered. They are the lowest cost commercial tubes you can buy.

Ask your local Alcoa specialist for more facts and figures to help you in long-range planning.

ALUMINUM COMPANY OFFERS NEW BOOK

This new, 24-page booklet will answer many of your questions about Alcoa Tubes. It covers fabrication techniques . . . alloy selection . . . applications both chemical and petroleum. It describes tube cleaning, the use of inhibitors and methods of cathodic protection. It contains complete information on fluid flow and heat transfer characteristics, plus tables of physical properties and specification data. Write for your free copy today: ALUMINUM COMPANY OF AMERICA 1863J Gulf Bldg., Pittsburgh 19, Pa.

TUBING WITH ALCOA ALUMINUM



Aluminum tube sheets should be used wherever possible. For best corrosion resistance, use Alclad 4S-F Alloy Plate. For high operating pressures, use high tensile strength 61S-T6 Alloy Plate.

Existing commercial practices should be followed for tube hole spacing. Grooved tube holes may afford tighter tube joints, but are not necessary. Standard tools and techniques are used for rolling-in Alcoa Tubes.

The use of steel tube sheets is satisfactory in most fresh cooling waters. If necessary, cathodic protection may be provided in the form of zinc strips or zinc metalizing of the tube sheets.

Complete fabrication, installation and service information is contained in Alcoa's new booklet, "Alcoa Aluminum Heat Exchanger Tubes." Write for your free copy.

If you're all "gummed up"

in a tough heat transfer problem

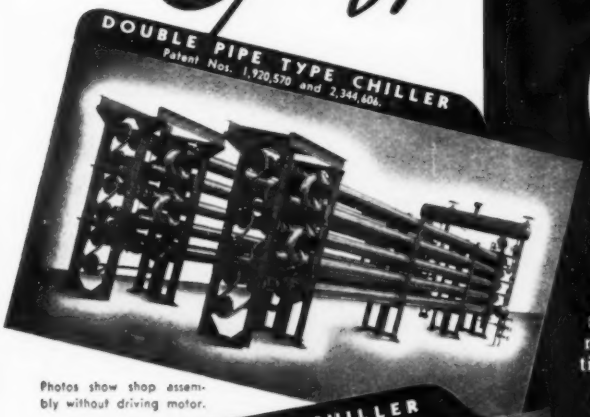
Specify..

Vogt Spiral, Spring Type Scraper
Patent No. 2,117,175

Vogt

SCRAPER TYPE

CHILLERS



Photos show shop assembly without driving motor.

Fouling of the inner pipe surfaces of Vogt Chillers is eliminated, because they are swept clean continuously during operation by patented spiral, spring type scrapers. And these clean surfaces achieve the highest possible rate of heat transfer between the solution and the refrigerant.

VOGT DOUBLE PIPE TYPE CHILLERS are designed to use ammonia, brine, or cold dewaxed oil as the cooling medium. Oil or brine, when employed, is circulated through the jacket pipes countercurrent to the flow of the solution in the inner pipes.

MULTI-PIPE TYPE CHILLERS, for direct expansion, have large jacket shells each containing seven inner pipe sections and employ volatile refrigerants such as ammonia, freon, propane, etc.

Our engineering staff is qualified by training and experience to help you find the right answers to your heat transfer problems. Their recommendations are available without obligation.

HENRY VOGT MACHINE CO.
INCORPORATED
LOUISVILLE 10, KENTUCKY
BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS

Think of this sign first . . . . . .

for ***Ethylene***

Manufacturing Facilities

The Lummus reputation for keeping its sights leveled at highly practical objectives is of particular value in the designing and constructing of ethylene manufacturing facilities. The very stature of ethylene—most important of hydrocarbon raw materials for petroleum chemical synthesis—should make such a point of view attractive to industry.

First, Lummus places emphasis on processing for higher yields and lower costs. Detailed processing and engineering studies dictate the scheme to be employed for specific operations. The company's fund of knowledge covering all commercially-applied techniques for making ethylene carries on from there. Lummus' pilot plant and development work have produced important tools to achieve maximum performance and flexibility. Special Lummus cracking heaters meet specific requirements for converting ethane, propane, or mixtures of both to an ethylene-rich effluent.

Second, Lummus places emphasis on the design of ethylene units for lower initial outlay, thus increasing the refiner's profit margin and diversity of income. This is extended to include recognition of metals-availability in the period ahead, as well as planning for rock-bottom maintenance and upkeep costs.

Third, Lummus recognizes the special responsibility of handling confidential information in accordance with the best interests and desires of the customer.

We invite you to think of Lummus first in *your* plans for petroleum chemical expansion.

LUMMUS

THE LUMMUS COMPANY

385 MADISON AVENUE, NEW YORK 17, N. Y.

CHICAGO • HOUSTON • LONDON • CARACAS • PARIS

DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

PETROLEUM CHEMICALS DIVISION
NEWS

September ★ *One of a Series of Interest to the Petroleum Industry* ★ *1951*

New Houston Office for Gulf Coast District

The Gulf Coast District Office of the Du Pont Petroleum Chemicals Division will soon move into its new Houston headquarters. The new offices are located in the recently completed National Bank of Commerce Building. They are considerably larger than those formerly occupied by the Division's Houston staff and pleasant surroundings have been created by one of Houston's leading decorators.

Superintendent of TEL Manufacturing Area

H. CLIFFORD BAILEY is superintendent of the Tetraethyl Lead Area of the Du Pont Chambers Works at Deepwater, N. J. He joined the Company in 1924 after graduating from M.I.T. and started his Du Pont career as a chemist in the Jackson Laboratory.

H. CLIFFORD BAILEY

In 1925 he was transferred to the Chambers Works. Here he held three jobs successively as a supervisor of the Phenylglycine operation, the Indigo Area and in the Tetraethyl Lead Area. In 1937 he was transferred to the Baton Rouge, La. plant as assistant manager.

After a period in military service he returned to Du Pont and was made technical assistant, Petroleum Chemicals Division, at the Wilmington office. In 1950 he was transferred to the Chambers Works to his present job of superintendent in charge of TEL manufacture.

New Du Pont Color Movie Dramatically Depicts Safe Gasoline Transport by Tank Truck

Film Available to Petroleum Industry for Showings to Municipal Authorities, Safety Groups, Civic Organizations

WHAT do Mr. and Mrs. America think of your gasoline trucks? Judging from reports in publications, and various restrictive regulations, they have some false notions about the safety of these vehicles. Since tank trucks are indispensable, something has to be done to change their minds. But what?

"IS THAT GASOLINE TRUCK SAFE?" asks a finicky lady motorist of our tank truck driver. In the new Du Pont movie, his clear explanation of the facts convinces her that the truck *is* safe.

To help the petroleum industry overcome this prejudice, Du Pont has produced a full-color sound movie on tank truck safety. This film is available to oil companies. It is a Hollywood-produced picture entitled "Pipeline on Wheels." The film is specially designed to give the public the facts about the safety features found in tank trucks built today.

Realistic acting and careful script writing point up the story. Forcefully and memorably the new film presents a winning case for the tank truck. Its message is in the form of an entertaining human-interest story. The chief characters, played by Hollywood actors, appear as typical, motoring-conscious Americans.

Throughout the picture, four main points are stressed: (1) The importance of the gasoline tank truck in our modern motorized civilization. (2) The fact that tank trucks are engineered and constructed for great strength and safety. (3) Evidence that tank trucks protect and retain their cargo even when rolled over or exposed to fire. (4) That size is no evil in tank trucks because large loads mean fewer trucks on the highway and, consequently, fewer exposures to traffic hazards.

Besides filling a definite need in public education, the film is ideal for training use. It can be employed effectively to develop job pride among tank truck drivers and maintenance men. Step by step, it shows how the modern tank truck is built to strict specifications for maximum safety. In two spectacular

SPECIAL

In this issue . . .

see back page for progress story on Du Pont's new TEL manufacturing facilities.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT

CONTINUED

New Movie

demonstrations with a full-size tank trailer loaded with actual gasoline, the movie proves conclusively that a gasoline truck can be rolled over without spilling and that it will not explode—even when subjected to severe fire beneath it.

In preparing the script, Du Pont consulted representatives of the Board of Fire Underwriters, the National Safety Council, the National Fire Protection Association, the API and NPA, as well as many automotive engineers and oil company personnel—over 100 people in all. These men cooperated enthusiastically and many offered sound suggestions which were incorporated in the film. As a result, "Pipeline on Wheels" is as authoritative as it is possible to make it.

THE SAFE CONSTRUCTION of a gasoline tank truck is stressed in this driver training scene from "Pipeline on Wheels."

Prints of the film are available to oil companies for use as they see fit and may be borrowed or purchased through any Du Pont Petroleum Chemicals Division District Office. The showing time is 26 minutes.

"Pipeline on Wheels" provides a feature attraction around which can be planned meetings with civic organizations, public officials, fire or police departments and other interested groups. And it provides a valuable supplement to training programs for tank truck drivers and oil industry personnel in general.

THIS "TAKE-HOME" BOOKLET, describing the movie in detail, is available to oil companies for distribution in connection with showings of "Pipeline on Wheels."

New TEL Manufacturing Facilities Well Under Way at Du Pont

To help meet the growing demand for tetraethyl lead compounds, construction of Du Pont's new manufacturing plant is now well under way at Deepwater, N. J. These facilities, using a new, more efficient manufacturing process, are expected to be in production by January, 1952.

As a result, refiners can look forward to an additional supply of TEL to help them maintain their quality standards and to meet increased gasoline demands. Also, TEL will be more readily available whenever its need for military fuels is urgent.

Construction of the new facilities is being accomplished with a minimum of critical defense materials. The specially designed processing equipment, for example, requires a smaller amount of special steel alloys than the former type.

To keep construction moving at top speed, a crew of nearly 200 men is employed in building the new three-story plant. The building itself is on the Du Pont Chambers Works grounds near the present TEL manufacturing area. Du Pont also plans to maintain full production in the present facilities.

AS THE STEEL WORK of Du Pont's new TEL plant nears completion, the job foreman checks construction details.

LITERATURE AVAILABLE

The Petroleum Chemicals Division of Du Pont has published a wide variety of material of interest to the petroleum industry. This includes technical papers, bulletins, reports and memoranda as well as equipment operation bulletins, safety regulations, tank cleaning data, marketing aids and the like.

Any of this is available on request to your nearest Du Pont Petroleum Chemicals Division District Office. A partial listing of available material is shown below:

Possible Mechanisms By Which Combustion Chamber Deposits Accumulate and Influence Knock
Serial A-2087a

Tank Talk—a 52-page booklet which outlines safe procedure for cleaning gasoline storage tanks. Written for the man who does the cleaning
Serial A-1134

Antiknock Antagonists—by H. K. Livingston, Jackson Laboratory

Du Pont Services to the Petroleum Industry
Serial A-663

MOVIES AVAILABLE

Pipeline on Wheels—A 26-minute, full-color movie on tank truck safety. Suitable for both training and public relations purposes.

What Makes A Gasoline Good—An 18-minute cartoon movie in color. Presents the story of how high quality gasoline is made in easy-to-understand form. Ideal for dealer training meetings.

In addition to the above, Du Pont makes available a special library of films of particular interest to the petroleum industry.

DU PONT
Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

District Offices: New York, N. Y. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · Los Angeles, Calif.

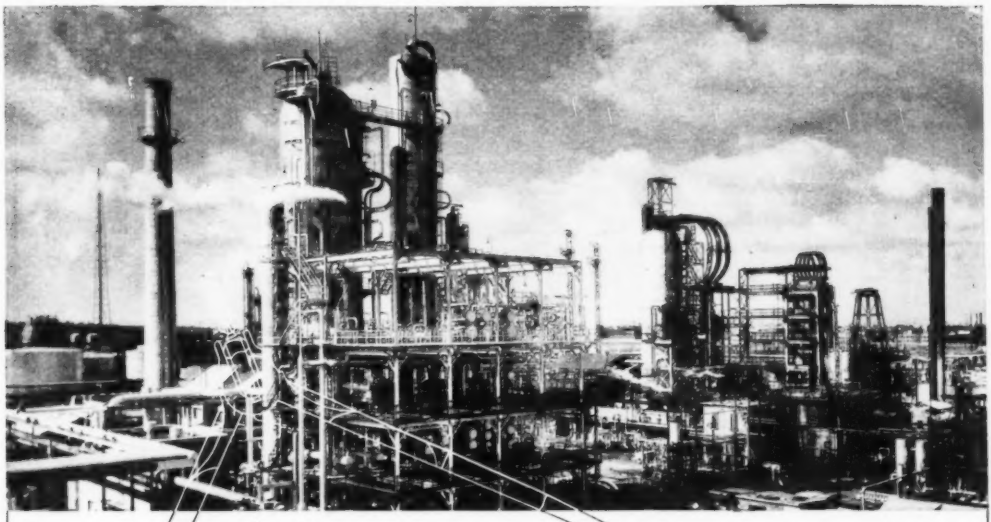
District Laboratories: Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · El Monte, Calif.

IN CANADA: Canadian Industries Limited — Toronto, Ontario — Montreal, Quebec

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-2292

Printed in U. S. A.



Pritchard Designs for Versatility and Accessibility

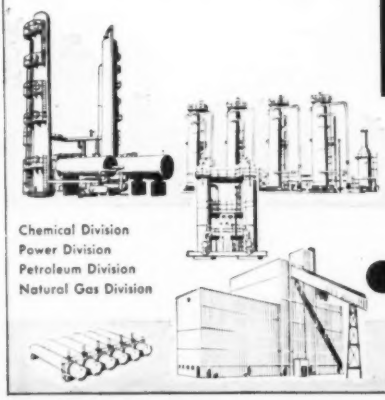
Our Single Responsibility Contract includes:

- Design
- Processing
- Engineering
- Purchasing
- Field Construction
- Guarantees
- Operating Tests
- "Turnkey" Basis

This unit is typical of Pritchard's forward looking ingenuity in Design, Engineering and Construction. Designed to the customer's requirements for replacement of an existing crude unit and for processing six different types of crude oil at a nominal capacity of 22,500 bbls. day, this unit simultaneously produces eight different distillate fractions ranging from light gasoline to cylinder stock!

At the same time particular care was taken to design the unit for maximum accessibility to the heat exchanger equipment, thus facilitating handling and reducing "shut down" time and maintenance costs.

For the most modern advancements in petroleum processing, let Pritchard engineers develop your next project from drawing board to "on stream."



Chemical Division
Power Division
Petroleum Division
Natural Gas Division

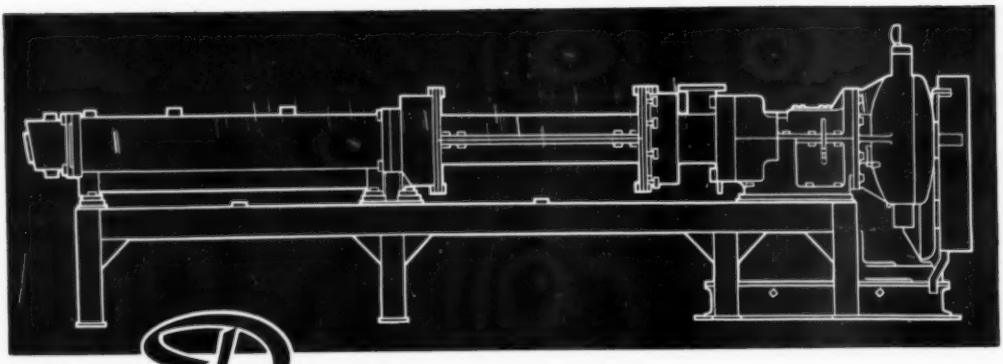
NATIONAL CONSTRUCTORS ASSOCIATION MEMBER

J.F. Pritchard & Co.

DESIGN • ENGINEERING • CONSTRUCTION

Dept. No. 155 908 Grand Ave., Kansas City 6, Mo.

District Offices: CHICAGO • HOUSTON • NEW YORK • PITTSBURGH
TULSA • ST. LOUIS • Representatives in Principal Cities from Coast to Coast



Presenting
WELDING ENGINEERS Revolutionary New WAX CRYSTALLIZER

FOR THE Continuous AND Uninterrupted SLABBING OF PETROLEUM WAXES

The Welding Engineers ONE-OPERATION Wax Crystallizer* incorporates the use of dual counter-rotating screws which progress the molten feed continuously through the jacketed barrel effecting rapid and efficient heat transfer. Without interruption, the extruded plastic-like wax ribbon is automatically cut into slabs which travel through a stainless steel trough for final cooling. The introduction of Welding Engineers wax crystallizing method into your plant will substantially lower your labor costs—only one man is required to operate as many as three crystallizers with a total 24-hour production rate of 66 tons.

VERSATILE: All types of paraffin and microcrystalline waxes can be handled • Sticky, tacky non-moldable blends are extruded and slabbed by the Welding Engineers Wax Crystallizer • Many high melting point waxes can be processed at the machine's top production rates.

Your present refrigeration or natural cooling facilities are applied easily to the new Welding Engineers space-saving wax crystallizer method. Clean: Molten wax is piped direct to the closed crystallizer barrel . . . a continuous stream of slabs leaves the cooling trough ready for packaging . . . Few moving parts mean extremely low maintenance . . . no down-time for costly replating operations.

*Patents Pending

A presentation of your wax production data will guide us in recommending crystallizing equipment for your plant

MACHINERY DIVISION—WELDING ENGINEERS, INC.
NORRISTOWN, PENNSYLVANIA

Manufacturers of Specialized Extrusion Machinery For The Petroleum, Chemical and Plastics Industries

NEW TRANE BRAZED ALUMINUM SURFACE

MORE HEAT TRANSFER EFFICIENCY

in $\frac{1}{4}$ the space

with $\frac{1}{3}$ the weight

at $\frac{1}{2}$ the cost

A Smaller Unit Can Do A Bigger Job

More heat transfer from every cubic foot of space, more Btu's from every pound of surface, more Btu's per dollar – with the new Trane Brazed Aluminum Heat Transfer Surface.

Many of these Brazed Aluminum Units can pack *450 square feet* of heat transfer surface – working surface – into *one cubic foot*. That's up to *nine times* more surface than a shell-and-tube unit with ¾" tube can put into the same space.

In a given space, the units can meet practically any specifications of heat transfer, pressure drop, volume, number and direction of passes, and fluid velocity.

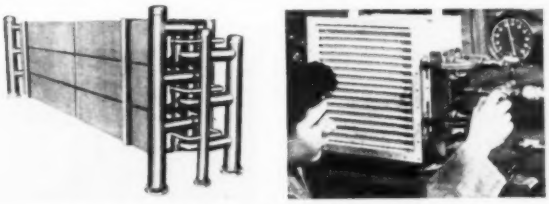
All aluminum, the units are much lighter than shell-and-tube heat exchangers – often needing only ¼ the weight to do the same job.

The units handle as many as five liquid or gas streams at once. Headers can be designed for any job.

Trane Brazed Aluminum Surface, evenly brazed in an exclusive flux bath process, is as rugged as it is flexible – it takes test pressures up to 1,000 lbs. per square inch, temperatures from –300°F. to 500°F.

Because they pack so much heat exchange surface into every cubic foot, and because of advanced manufacturing techniques, the units are much less costly than conventional equipment – a smaller unit can do a bigger job. *Trane Brazed Aluminum Units can often do the same heat transfer job as tubular exchangers that cost two or three times more.*

If you have a heat transfer job – one that demands a large number of units – Trane Brazed Aluminum Surface may be the answer. Contact your nearest Trane sales office, or write direct.



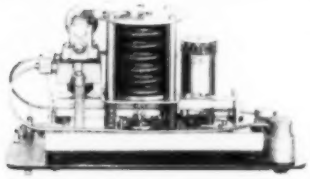
Large units – left, or small – at right, flexible Trane Brazed Aluminum Surface provides heat transfer efficiency.

THE TRANE COMPANY, LA CROSSE, WISCONSIN
Eastern Mfg. Division . . . Scranton, Pennsylvania
Trane Company of Canada, Ltd. . . . . Toronto
OFFICES IN 80 U. S. AND 14 CANADIAN CITIES

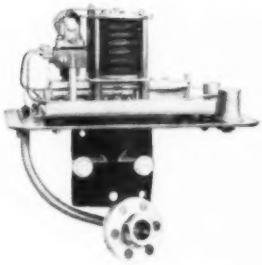
TRANE

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

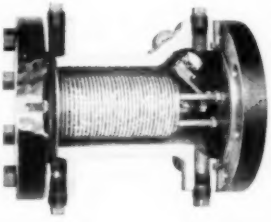
MEASURE



Taylor TRANSAIRE® Transmitters virtually eliminate time lag in measuring and transmitting smallest temperature and pressure changes. Temperature model (*left*) has derivative action, SPEED-ACT®, in measuring circuit, which assures dynamic accuracy under changing conditions. Pressure model (*right*) will detect changes of 1/10 of 1% of the range span, accurate to 1/2% of span rather than pressure level. Temperature and barometric compensation assure consistent accuracy.



Taylor Differential Pressure Manometers give accurate, dependable measurement of flow, liquid level and specific gravity. Mercury model (*left*) is accurate to 1/2 of 1% of the range, has interchangeable tubes for continuous ranges from 10 to 500 inches of water. Aneroid (mercuryless) models (*right*) of 300 and 1500 psi working pressures. Range limits: 0 to 20" to 0 to 500" water. Also available in all-316 stainless steel for corrosive mediums.



EVERYTHING'S

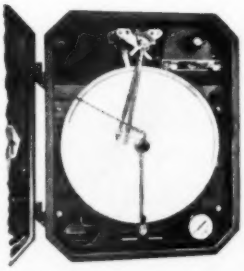
RECEIVE

The TRANSET Recorder (*left*) has automatic-manual unit, remote set-point adjustment and valve position indicator. Takes only 4 3/8" x 5" panel space, gives a continuous 30-day linear chart record, with 3 hours visible. Electric or pneumatic chart drives.

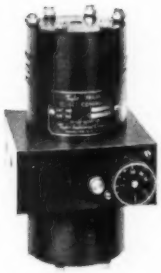
The TRANSET Indicator (*right*) has all the features of the TRANSET Recorder, but gives no chart record. Easy reading 3 1/2" dial, mounts in same size panel opening as TRANSET Recorder.

TRANSET Receiving Flow Integrator (*left*) also takes just 4 3/8" x 5" panel space. It totals the flow of liquids and gases, is available in square root or linear forms. Like the other TRANSET Receivers, its small size makes it ideal for graphic panels.

Taylor 84JF Recording Receiver (*right*) is an alternate part of the TRANSET System designed for those who want matching cases on conventional panel boards. Has all the features of the small TRANSET Recorder, but utilizes standard 12" circular charts.

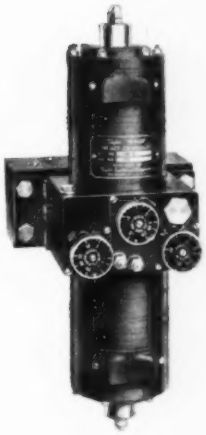


CONTROL



The TRI-ACT* Controller *(right)* is a force-balance pneumatic controller with a new circuit embodying three control responses: proportional, PRE-ACT* (rate action) and automatic reset. Gives precise control never before believed possible, with faster, more stable recovery on load changes, no overpeaking on start-up. Can be locally or panel mounted.

BI-ACT* is TRI-ACT's little brother. The BI-ACT Controller *(left)* is a lower cost instrument with *two* control responses, proportional and automatic reset, both adjusted with *one* stability knob. It's the ideal instrument for dependable, accurate performance on those applications where the quality of control obtainable with derivative response is not essential.



UNDER CONTROL

with Taylor's TRANSET System regulating any process variable*

*Trade Mark

THE ANSWER to almost any industrial control problem is on these pages. Taylor's New TRANSET Control System can control practically any process variable, with a precision never before possible.

A wide variety of units available within each of the system's three steps, measuring, controlling and receiving, makes TRANSET Control adaptable to fit your control requirement perfectly. Each unit incorporates brand-new features and techniques, and the units in each step are designed to take fullest advantage of the superior performance of units in the other steps. It's an unbeatable team that can cut costs and improve product quality in any process industry.

For full information on how you can profit from Taylor TRANSET Control, ask your Taylor Field Engineer, or write for **Bulletin 98097**, Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

Taylor's Centennial

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

(To obtain more data on advertised products see page 1028)

If you have a Boiler Water Problem investigate....

GRAVER ZEOLITE WATER SOFTENERS

Is your water supply unsatisfactory for boiler feed because of hardness . . . alkalinity . . . silica . . . or any other impurity?

No matter what may be your problem, you'll find the correct solution in exactly suitable Graver processes and equipment. For example:

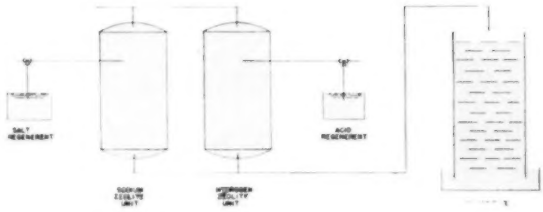
SODIUM ZEOLITE for elimination of hardness

HYDROGEN ZEOLITE for elimination of both hardness and alkalinity

DEMINERALIZING for elimination of ALL electrolytes, with silica removal, too, if necessary, producing the equivalent of distilled water at a fraction of the cost.

And if any other water treatment is required for your particular plant conditions, equally effective Graver processes and equipment are available . . . *Hot Process* . . . *Cold Process* . . . *Deaeration* . . . *Filtration* . . . *Removal of Special Impurities.*

Write for information on processes and equipment in which you are interested . . . there's no obligation.



GRAVER HYDROGEN-SODIUM ZEOLITE BLEND SYSTEM

The completeness of the Graver line of water conditioning processes and equipment makes Graver recommendations impartial . . . just as the 40-year experience of the Graver engineers and chemists makes their recommendations authoritative.

These are some of the reasons why critical engineers of leading plants in every industry have selected Graver equipment for their water conditioning requirements.

●

Send for Technical Articles on "Operating Experiences with Resin Zeolites on the Hydrogen Cycle", "High-Pressure Boiler Feedwater Treatment", and "Boiler Feedwater Treatment for a High-Pressure, High-Make-Up Power and Steam Producing Plant".

GRAVER

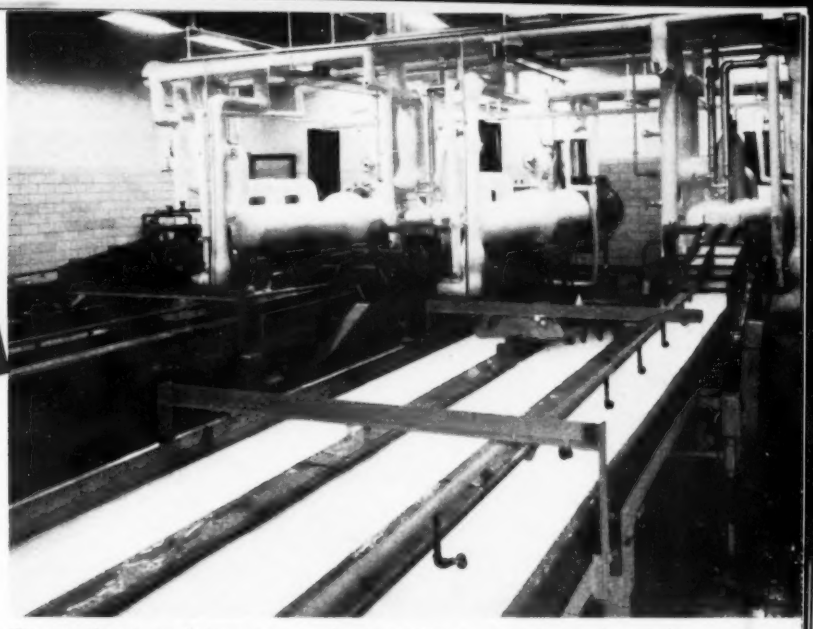
GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

216 WEST 14th STREET, NEW YORK 11, N. Y.

GW 448

PETROLEUM PROCESSING
SEPTEMBER, 1951



This Month's Cover Picture shows a closeup of the new extrusion equipment for molding paraffin wax slabs on a continuous production-line basis

New Method of Slabbing Wax

Texaco installation forms cakes by extrusion, can turn out 66 tons/day with one operator

By D. P. THORNTON, Jr.
Southwestern Editor

NEARLY two years ago, The Texas Co. conceived the idea of continuously extruding wax in the form of a ribbon, subsequently cut to the desired length, as an improvement over wax molding methods then in use at its plants. At that time an enlargement and modernization of its paraffin wax facilities in conjunction with new solvent lube units at the Port Arthur Works, Port Arthur, Texas, was under way.

In the past, the process of producing slab wax had remained for decades an operation of pouring molten wax into a mold, chilling until solid, removing and packaging—a process employing largely hand labor.

When the Texas Co.'s engineers began investigating their idea of continuously extruding wax, they learned that several designs of dual-screw extruding and crystallizing machines had been developed by the Machinery Division of Welding Engineers, Inc. One design in particular combined crystallization of a molten compound with extrusion in a formed shape. The materials it could handle were limited to those possessing a plastic range between the molten and solid states, a requirement which could be fulfilled by paraffin waxes.

Adaptation of the crystallizer to the production of slab wax was worked out cooperatively by the two companies, with final design and construction of the commercial equipment being handled by Welding Engineers after extensive development work.

The only commercial wax slabbing installation employing this method to date, and which until now has not been publicly announced, is at the Port Arthur Works of The Texas Co. Three extruders with a combined capacity of 66 tons daily now are in use at that plant. The slabs produced there are the conventional 10 lb. size in white, fully-refined wax of 122-124, 125-127, 130-132 and 135-137 EMP (English Melting Point) grades. Other EMP grades, including high melting point or microcrystalline waxes, can be handled on the same or similar equipment. Application of this equipment to microcrystalline waxes has been investigated by Welding Engineers on pilot plant facilities.

The method used at Port Arthur is entirely continuous, requiring a single operator for one or all of the three machines installed. The only hand labor required is in packaging the wax in cartons or bags, the manpower requirements then depending on how many machines are in operation. The Port Arthur Works now has no conventional 10-lb. plate-and-frame slab molders; quarter-pound cakes, however, still are made in the conventional manner and packaged mechanically.

The slab wax produced by the crystallizer-extrusion method has an entirely different physical appearance than that of conventionally-

Wax Crystallizer

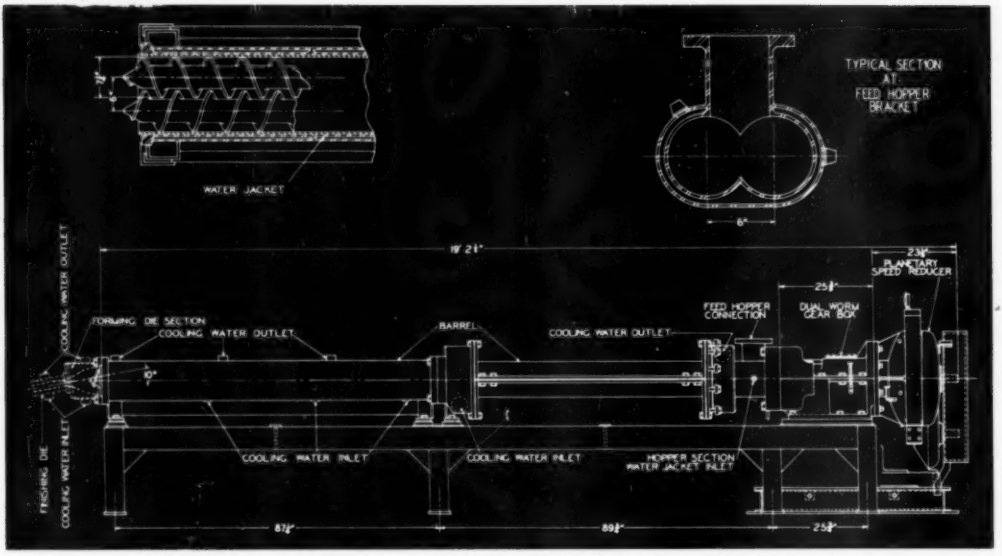


Fig. 1—Machine drawing of wax crystallizer, showing wax entry, screw configuration and conformation of forming and finishing dies

molded paraffin wax, although it is unchanged with respect to other physical properties. It is, of course, still white but the cakes are less translucent and do not have the characteristic snow-whiteness of cast wax; the density is unchanged, although the large surfaces are somewhat more irregular.

When extruded wax cakes are dropped, the corners may be deformed but generally do not even chip, nor is the slab broken. A violent blow is required to break the slab, the fracture exhibiting a laminated structure similar to that of shales. Dropping from shoulder-height onto concrete or tile ordinarily will not break the extruded slab but frequently shatters a conventionally-cast slab at the same temperature.

Extrusion Process

The wax crystallizer or extrusion machine, as it is variously called, is the heart of the new, truly continuous process. It is shown in detail in Fig. 1. The entering molten wax is chilled by contact with the cold inner surface of the machine, scraped off by a pair of meshed, close-fitting stainless steel spiral screws (each similar to the single screw used in the familiar household meat grinder), which mix the molten and crystallized phases until solidified.

From this point until it enters the forming die the wax is "churned" repeatedly, to become highly compacted in the die. The forming die brings the wax mass from the figure-8 shaped barrel, in which the screws rotate, to approximately the cross-section of the finished slab. The extruding die shapes the wax mass into final form. At the end of the extruder a power shears, triggered by an electric eye, cuts the 1.5 by 12-in. ribbon of wax into slabs 19.25 in. long.

Fully refined, molten wax enters the machine via a level-controlled stainless steel jacketed hopper direct from insulated, heated storage. En-route, its temperature has been corrected by tempering heat exchangers so that it enters the hopper at 10° above its EMP melting point.

Hot water is withdrawn from storage through a water-tempering exchanger against plant cooling water and thence through the wax-tempering exchanger to provide wax at the proper hopper temperature. With the unit "in balance," it normally is not necessary to use cooling water in the tempering exchanger. Wax enters the wax exchanger considerably above its melting point, there being no provision to control this at Port Arthur except that an attempt is made to avoid temperatures in the wax storage tanks in excess of 160° F.

From the hopper, wax enters the crystallizer barrel of the machine (Fig. 1), flooding the dual screws. The screws have a quarter-inch clearance between the periphery of one flight and the corresponding root of the other. The periphery of the flights clear the wall by a few thousandths of an inch. Water flow through the cooling jackets around the barrel is intended to progressively lower the average temperature of the wax to 20 or 25° below its melting point, but still within the plastic range, by the time it enters the forming die.

Both the "forming die" and the "finishing die" are water jacketed, with separately-controlled streams. The function of the forming die is to shape and weld the plastic wax together as it comes off the screws until, as it reaches the end of the die, it assumes the shape of a ribbon of wax. Die temperature is maintained within 1 to 2° of the wax melting point.

The finishing die, which gives the ribbon of wax its final dimensions, is likewise water jacketed to maintain a temperature of approximately 5° *above* the wax melting point. This melts a thin skin of surface wax, enough to provide "lubrication" for the ribbon of wax passing through its 1.5 by 12 in. opening. It is not tapered but allows the wax to flow smoothly from the tip of the forming die into its cross-section.

A short conveyor belt receives the still-plastic slab from the extruder, and while on it the wax is chilled and prevented from sticking to the belt by a spray of 35° water. It moves more rapidly than the wax is extruded, to give a positive "pull" on the wax. The belt deposits the slab in a trough of moving 35° water where, for a distance of approximately 10 ft., it also is sprayed with the chilled water. The wax then moves slowly down the trough, for a total distance of about 140 ft. and a total time of 27-30 min. At approximately every 50 ft. or twice en-route, it is turned over by ingenious paddles, and upon emerging from the trough it is picked up by another

conveyor and deposited on the main conveyor belt to the packaging room.

Turn-over of the wax slab is necessary to cool it as uniformly as possible from all sides and thus minimize surface warpage from thermal stresses. The "paddle" consists of two perforated stainless steel plates attached to a shaft, like an offset design of a butterfly valve or pipe damper, which is rotated periodically through a unidirectional 180° arc by a half-horsepower motor and reduction gear, suitably equipped with limit switches. The slab is submerged during the turn-over. Two "fingers," one in each trough, actuate microswitches controlling the motor so that it cannot operate unless a slab is correctly positioned on the upstream side of the "paddle" and there is no wax in the way, downstream. The flow of water in the troughs moves the slabs along.

Linear travel of the wax, from the time it enters the extrusion machine until it drops on the final conveyor belt to the packaging room, is approximately 16 ft. in the crystallizer-extruder and approximately 140 ft. in troughs and on the extractor conveyor. The extruder itself is 22 ft.-4 in. long, including driving motor and reduction gearing. It is not necessary to further age or temper the wax before packing in conventional 80-lb. cartons, 200-lb. bags or loading a car with loose slabs. Full advantage is taken of commercial mechanical handling equipment to move slabs in the packaging room and to freight cars.

Unfortunately it is not possible to bring the wax well-below its plastic point while it still is in the finishing die because otherwise it could not be extruded as a ribbon. Consequently, even after it leaves the receiving conveyor and enters the troughs, it still is internally warm long after the outer surface is quite hard and cool, due to the low heat transfer coefficient of solid paraffin wax.

This gives rise to a production problem which has not as yet been solved: how to eliminate surface irregularities, due in part to warpage from thermal stresses and also to the effect of "plastic memory," which occur until the wax is cooled throughout to around 75° F. This in no wise affects wax quality or consumer-processing characteristics, but it is less easy to stack and, of course, cannot be handled on automatic packaging machines.

The weight variation between extruded cakes is from 10.0 to 10.5 lbs., or 10.25 average. The cake formerly produced from the plate and frame molds averaged 10.5 lbs. with a variation of approximately ±1 oz. The present variation is gradually being brought down as experience is gained with the machines and in the interim each package is being stenciled with its exact net weight of wax.

This problem, although of little consequence from strictly a processing standpoint, currently is under study both by The Texas Co. and Welding Engineers. An adjustment in design of the forming die is believed to hold the solution, now that an improvement in temperature control of the water to the dies has been achieved.

Crystallizer Design

The crystallizer as shown in Fig. 1, consists essentially of a figure-8 shaped barrel in which dual screws rotate in opposite directions and at close clearance. One of the screws is driven through a special Welding Engineers planetary gear and gearbox and, in turn, drives the other screw. The planetary is driven through a Reeves speed-reducer by a 15 Hp. motor.

The wax drops from the hopper directly between the forward ends of the screws, where it is picked up and churned over and over again as a thin skin forms on the chilled walls of the barrel until it has completely solidified, although it still is plastic. One of the principal features of this process, and which is primarily held responsible for the unusual strength of the extruded product, lies in the meshing and interweaving of the wax crystals brought about by the dual screws while the wax still is plastic.

From a process standpoint, the shape and clearance of the screws and conformation of the forming die are the two critical design points of the equipment.

As may be imagined, very close tolerances and careful design went into the configuration of the screws, the clearances between their peripheries and the barrel, and between periphery of one screw flight and the root of the other. Indeed, the original screw design, for instance, gave a machine production in actual operation of approximately 18 tons per day, considerably below expectations. Reworking the design to give closer clearances promptly increased production to 22 tons per day.

The configuration of the forming die likewise is important to the quality of the finished slab. The wax comes off the screws in two principal streams. It must not be allowed to "eddy" and "dead spots" may not be allowed to develop in welding the wax into a ribbon as it smoothly passes into the forming die. Temperature control is important here, too, as between the change of shape and temperature, just the right amount of resistance, or "back-pressure" must be introduced to produce a satisfactory slab without stalling the machine.

Comparatively, the finishing die has a less important role because it simply places the finishing touches on the shape of the ribbon, as its name implies.

The speed of rotation of the screws is a function of the melting point of the wax being processed and its plastic range as well as the coolant temperature and rate. If the speed is excessive, wax will be moved too rapidly through the machine and emerge only partly crystallized. If too slow, the wax will become chilled below its plastic range before extrusion and cause a freeze-up.

The barrel is provided with five separate cooling jackets, as indicated in Fig. 1. In the first half of the barrel the jacketing is a spiral, the water inlet being near the middle and the outlet just before the hopper section. In the remaining half there are three separate jackets which may be connected in series or parallel as desired. The fifth jacket is around the hopper section and normally is maintained at the same temperature as used around the hopper.

Jacket Water Supplies

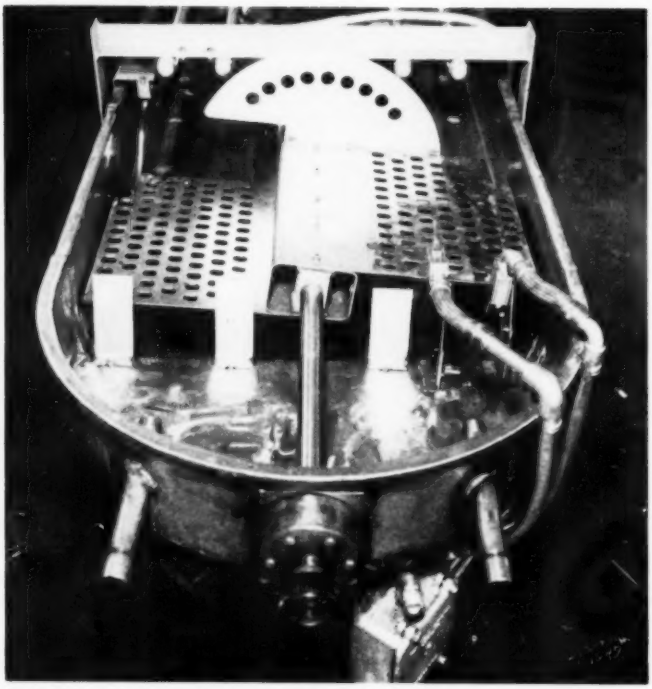
Each of the three machines at Port Arthur is supplied with four separate streams of water, each independently controlled. The 35° water flows to the barrel jacket of each extruder and to the respective cooling troughs and came originally from the plant potable water system.

Although the barrel jacketing is compartmented so that five distinct cooling zones could be established, it has not been found an operating convenience to utilize these and instead a straight-through series flow from one end of the barrel to the other is used. Water is not supplied to the jacketing at the point where the wax enters the barrel of the crystallizer (hopper section).

Warm water for the forming and finishing dies, respectively, is taken from the plant process supply and passed through two independently controlled steam heaters; each extruder has a separate set of these. Steam from the plant 150 psi. system is admitted to the water through a "Sarco" bellows-actuated throttling valve, thermostatically controlled, which can be set manually to deliver the desired water temperature. This system has proven highly flexible and gives more satisfactory control than the instrument-type pneumatically actuated valve control originally installed.

Still another separate system delivers hot water under manual control to the inlet nozzle of the extruder jacketing, so that cold water may be cut off and hot water substituted in event the wax should "freeze" in the machine and stop it. This feature will be further discussed under operations.

Cold water at the maximum rate of 600 gpm. and 50 psi. for the extruders, quarter-pound plate-and-frame molds and building air conditioning is obtained from a 125-ton



Paddle mechanism for turning wax slabs over during the cooling period. This photo clearly shows the micro switches which actuate the paddle when a slab is properly positioned

per day Graham steam-jet refrigeration unit. Cooling is developed from evaporating enough water at 29.5 in. Hg. vacuum to maintain its temperature at the desired value. A Binghamton deep well pump circulates this water. Special seals in piping to the well were required to avoid introduction of air to the vacuum system.

The cooling system requires two steam jets, one on automatic and the other under manual control. With given conditions of loading, the manually operated jet is set wide open and any load fluctuations then are handled by the automatic jet. Should the load be less than one jet requirement, the manual jet is completely closed off. Steam condensate produced, incidentally, supplies all the make-up water required for the cold water system and the balance spills into the plant condensate return system.

Extruder Operation

The extruder is quite simple to operate, one man handling from one to three machines. His principal duties are to check temperatures of the three water streams, to see that the extruder drive is not overloaded by excessive cooling of wax in the barrel portion of the machine, and to see that no jams occur in the cooling troughs or conveyors.

Load on the screws is measured by a "Torqcontrol indicator." The actual reading of this instrument is purely empirical with each particular machine and design, but directly indicates the turning effort on the drive shaft and can be converted to inch-pounds of torque. Indirectly, it also indicates the pressure on the wax in the forming die. If the reading is too low, as determined experimentally, the wax will emerge molten from the machine in consequence of insufficient cooling. If too high, the wax will go below the plastic range, congealing in the screws from excessive cooling and stall the machine. A cut-out circuit incorporated in the "Torqcontrol" stops the motor before the machine can be damaged.

Intermediate between a torque reading which will warn of an incipient stall (screw speed too slow) and one so low as to indicate in advance that molten wax will be extruded from the machine (screw speed too fast), are the levels wherein the wax has not been allowed to sufficiently crystallize although a solid product will be obtained. In such cases warpage of the slab from thermal stresses during cooling are severe and the slab may be badly deformed.

On the other hand, at higher torques—above the level for a satisfactory product but not high enough to indicate an incipient stall—there is no apparent change in the slab density or reduction in warpage. There is, however, a very real possibility of stalling the machine and interrupting production. Hence the empirical operating control reading on the "Torqcontrol indicator" is the lowest at which experience indicates the most satisfactory-appearing slab (i.e., least warpage) is obtained.

Paradoxically, although it may appear serious, a stall is not a momentous upset processwise and can be readily corrected. If the machine stops, because the safety limit has been reached, cold water to the barrel jacket is cut off and drains to the sewer are opened by the operator. Hot water is turned on until the wax is fluid enough to allow the machine again to operate, whence the valves are reversed and cold water returned to the jacketing. A suitable adjustment in screw speed is made, as indicated by the "Torqcontrol", as the machine returns to "normal". Following the stoppage the next 10 or 15 slabs are rejected to remelt as they emerge until satisfactory slabs are obtained, based on the operator's judgment. Production is lost for no more than 10 minutes, normally.

In relieving a stoppage it is not necessary to warm the barrel very much—just a few degrees—and this process is aided by the fact that most of the wax in the screws is already near the melting point. By providing independent circulation of the emergency hot water, there is no upset in the refrigeration system which cannot be taken care of by the automatically controlled vacuum jet.

It should be noted, however, that a stoppage definitely is an emergency situation which never occurs in a "normal" operation. Without the safety provision incorporated in the "Torqcontrol", severe damage to the machine could result.

To bring an extruder on production is not much more complicated than starting up after a stall, although it takes longer. Wax supply lines are first warmed by the steam tracing, if necessary, and also the extruder jacket and dies, and wax hopper brought to proper temperature; meanwhile, the cooling troughs are filled and water flow established. Wax is admitted to the hopper when these temperatures are reached and the screws started. As soon as wax begins to solidify, screw speed is adjusted by the "Torqcontrol indicator" to the proper reading as determined by experience. The first few slabs are discarded until satisfactory production is reached. Subsequently, constant operator attention is not required.

Going off production starts with closing off the wax supply line, the extruder being operated until it has nearly emptied itself of wax. Hot

water—considerably above the wax melting point—then is admitted to all jackets in order to melt out any wax remaining; this wax is discarded to remelt. Meanwhile, the troughs have been allowed to drain as soon as they are clear of wax slabs, this water returning to the cold water supply in the usual manner.

A switch from one grade of wax to another may be accomplished by cutting off the supply and allowing the machine to run empty before introducing the new grade, or by merely switching tanks and running melting points on the supply wax until the change has been effected. Only 10-15 cakes per machine need be discarded when the latter method is used. All machines operate on the same grade of wax to preclude mix-ups in packaging, since the product from all three under the present arrangement lands on the same conveyor belt to the packaging room.

Actual capacity of the extruder is principally based on the melting point of the wax being handled and temperature of the available coolant. The figure of 22 tons daily (24-hour operation) is specific for 130-132 EMP wax only. With 122-124 EMP wax the capacity will drop to approximately 18-19 tons. This characteristic is a function of the temperature differential between the melting point of the wax and temperature of the water in the barrel portion of the extruder. Consequently, in processing high melting point waxes, where this differential is greater, the capacity of the machine should be considerably higher.

Cooling troughs in operation. Paddle at near end has just transferred wax from first to middle trough. Crystallizing machine is at far end. Conveyor at left removes slabs from third trough to packing room

Economic Considerations

It is not a simple matter to compare the extrusion method with the conventional plate-and-frame molding procedure in terms of manpower and space requirements. In general, however, manpower requirements are decidedly lower and capacity considerably higher.

The three extruders at Port Arthur, together with the associated cooling troughs and extraction conveyors—the conveyor to the packaging room could be used with either system—occupy more space than would be needed for three conventional molders each having a capacity of 240 ten-pound slabs, representing 2400 lbs. of wax per filling. This is because the offset position of the driving mechanism and requisite access space between each machine is greater than that required for the plate-and-frame molds. Also, the combined length of extruder and cooling troughs is greater than the length of the conventional molder.

In terms of tonnage capacity, the story is different. With three conventional molds it formerly was possible at Port Arthur to pack 18 tons per 24 hr.-day into 80 lb. cartons; 25 tons in 200-lb. bags or 26 tons in loose slabs. This allows for filling time, cooling and removing wax from the molds, and packaging. The labor requirement is intermittent, generally requires five men.

Three extruders of nominal capacity of 22 tons per 24 hr.-day will produce a total of 66 tons in 10-lb. cakes. One operator is required. With one to two machines operating, two men are sufficient for any method of packing; three are needed when three machines are operated. At most total men required is four per shift.

Life of the extruders and the amount of mechanical maintenance needed is not known. The installation has not operated sufficiently long to gain experience, but maintenance is expected to be less than for conventional molders.

The author is indebted to The Texas Co. for permission to publish this article and particularly to the Port Arthur Works staff for much information and assistance. Also to the Machinery Division, Welding Engineers, Inc., for mechanical details of the crystallizer and helpful criticism of the manuscript.

Other Production Line Techniques Developed

In addition to the method described in this article, at least two other mechanized, production-line techniques for the forming of slab wax have been introduced within the past year.

One commercially-used oil company method is understood to start with chip wax. This material, at or near the plastic point, is compressed into a slab by an hydraulic press.

Another oil company process molds wax in trays, just as several well-known candy bars are produced. Indeed, a modified version of the candy bar molding machine is used in connection with automatic packaging machinery to give a very high volume per day. Details on this method were disclosed in the August issue of PETROLEUM PROCESSING, pp. 840-843.

A fourth method is reportedly under development by a manufacturer of heat exchange equipment, but no reliable information on the technique is available.

W. S. Westwood, in charge of continuous scrap drive, keeps records and moves junk steel out as fast as possible

Bob Fabrey, metal inspector, checks salvaged pipe to see if it has any further use or should be scrapped

WANTED! Steel Scrap for Defense

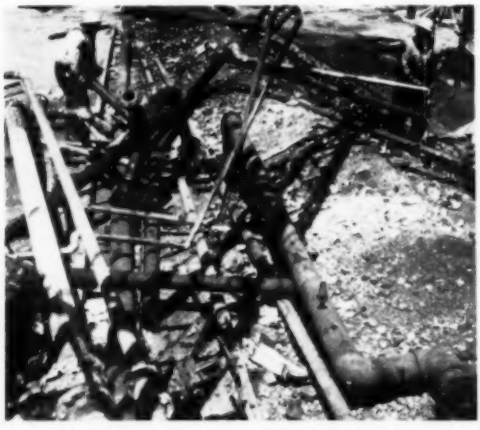
Sohio refinery "mines" 3575 tons of it in 2½ years

THE single most serious threat to full production of steel for the industrial mobilization program is the shortage of scrap. Recent comments by National Production Authority officials indicate that 1951 fourth quarter structural steel production, though high, still will not meet the needs for current expansion.

Vividly demonstrating what the petroleum processing industry can do is the continuous scrap steel program launched by Standard Oil Co. (Ohio) $2\frac{1}{2}$ years ago. In that period, the No. 1 refinery at Cleveland has recovered 3575 tons of scrap from old tanks, underground pipe lines, valves, fittings, etc.

That amount of steel is half again as much as was used to build the new cat cracker at the refinery or almost as much as will be used in the new $5,500,000 crude still now under construction.

The continuous program is under the direction of W. W. Westwood, with a crew of five engineers serving as metal inspectors. These men are constantly checking the condition of metal throughout the plant so that defective parts may be quickly replaced with new and turned into much-needed scrap. Their quota of 100 tons/month has been easily exceeded, the average thus far being about 119 tons. In addition to steel, some 73 tons of brass, lead and copper have been salvaged in the program.



Abandoned underground pipe lines contribute substantially to Sohio's steel salvaging program

Old pipe, some of it dating back to 1870's, is pulled out of ground on site of soon-to-be-built crude stills

Chemistry of Inhibitor Sweetening

This article is aimed at giving the reader a better understanding of the inhibitor sweetening process and its practical applicability. The author points out that normal butyl mercaptan enters into the inhibitor sweetening reaction with ease, that secondary butyl mercaptan does not undergo sweetening quite as easily, and that tertiary butyl mercaptan is characterized by relatively no sweetening reaction. Original experimental data on the chemical reactions involved in the process are presented, and interpreted with a mechanism which fits the facts and is consistent with present theories.

By R. H. ROSENWALD
Universal Oil Products Co.
Research and Development
Laboratories
Riverside, Ill.

THE term "inhibitor sweetening" refers to a process in which a sour gasoline (one containing mercaptans) is rendered sweet by an operation involving storage for short periods of time of the caustic scrubbed fuel in the presence of air and a substituted phenylene diamine type of inhibitor such as UOP No. 5 Inhibitor.

Judicious use of this process can mean an economy in refinery practice owing to the simplicity of operation. Involved plant alterations are not required to convert old treating equipment to inhibitor sweetening, and numerous refiners have changed to this simple and economical method of sweetening gasoline. The general conditions for the practical application of inhibitor sweetening have been described. (7)

The question arises, what are the reactions which take place and allow such facile disappearance of mercaptans? This article will elucidate some of the chemistry involved and account for the sulfur-containing products expected in the sweetening reactions. The interpretations to be made are based on an accumulation of experimental data, the nature of which can be gained by examinations of the results from selected experiments here presented.

It would be desirable, from a more practical point of view, to consider only data obtained using a motor fuel and mercaptans as ordinarily encountered. However, the complexity of motor fuel and the low concentration of mercaptans prevent a convenient treatment of the chemistry involved. It was found advantageous to use pure reactants and mercaptan concentrations higher than are normally encountered in commercial fuels. It has been observed that the fundamental reactions involved in these synthetic blends are similar to those which take place with sour fuels.

On the basis of preliminary work, it was found that the sweetening reaction involves the following reactants: olefin, mercaptan, oxygen, caustic, and inhibitor. The role of each was investigated by the preparation of mixtures and following the course of reaction with special study of these factors: amount of oxygen absorption; rate of oxygen absorption; disappearance of mercaptan; formation of disulfides; and formation of peroxides. The above factors were determined for mixtures containing the reactants in the following amounts:

Olefin	12-18 grams
Mercaptan	5-6 grams
Caustic	ca. .05 grams
UOP No. 5 Inhibitor	ca. .01 grams
Oxygen	ca. 1 atm. abs.

The caustic and inhibitor are employed in such amounts, about 5 mole % of the mercaptan, that the effects of these reagents must be considered "catalytic" in nature.

Table 1 and Fig. 1 summarize the data obtained with cyclohexene as an olefin, and with normal, secondary

Meet the Author

R. H. Rosenwald received his B.A. degree from North Central College in Naperville, Ill., in 1932. He did his graduate work in organic chemistry at the University of Minnesota and obtained his Ph.D. in 1936. After completing his academic training he joined the Research and Development Laboratories of U.O.P. at Riverside, Ill. His work has been in the field of additives, with particular attention to problems relating to autoxidation and antioxidants.

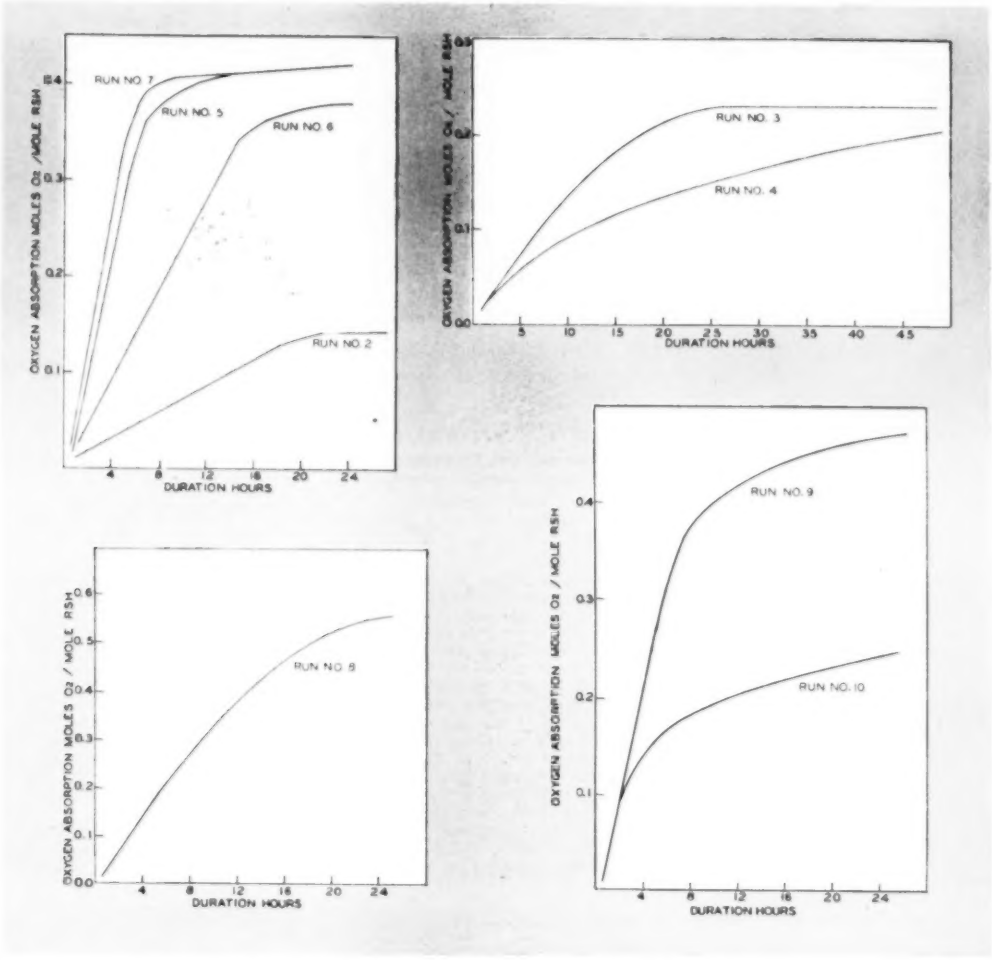


Fig. 1—Amount and rate of oxygen absorption during the inhibitor sweetening of cyclohexane. In runs 2 through 8, sulfur is present in the olefin as normal butyl mercaptan, in run 9 as secondary butyl mercaptan, and in run 10 as tertiary butyl mercaptan

and tertiary butyl mercaptan. The caustic employed was either a 20 wt.-% solution of sodium hydroxide or a refinery caustic obtained from plant operation. The data in Fig. 1 indicate the amount and rate of oxygen absorption as the runs progressed. The oxygen absorption is based on the moles of oxygen per mole of mercaptan, and an attempt is made to determine the rate of oxygen absorption by estimating the slope of the curve so obtained.

Examination of these results indicates the perceptible effect of the two additives. No appreciable reaction was observed to occur between olefin and *n*-butyl mercaptan in a period of 72 hours (Run 1). In Runs 2 and 3, the effect of caustic alone was to promote an oxidation according to the equation

$$4RSH + O_2 \rightarrow 2RSSR + 2H_2O$$

Comparison of results from Runs 2 and 3 reveals that the refinery caustic gave a slower rate of oxygen absorption and an incomplete consumption of mercaptan. The rate of oxidation and the products of reaction are dependent on the nature of the caustic and on the presence of certain additives. [1, 2, 5, 10]

In comparison to results from Run 1, the presence of UOP No. 5 Inhibitor in Run 4 brought about a noticeable reaction characterized by an appreciable absorption of oxygen and formation of disulfides in moderate amount. The reactions observed, which involve the olefin, are due to an induced oxidation prompted by some special property of UOP No. 5 Inhibitor. It can be calculated that for each molecule of UOP No. 5 Inhibi-

tor spent in the oxidation process, about 10 molecules of mercaptan were consumed. A comparable efficiency in a gasoline is ample to account for sweetening of a low mercaptan fuel with UOP No. 5 Inhibitor. However, a more efficient use of the inhibitor is possible as follows.

It is the combined effect of the two additives, caustic and UOP No. 5, that promotes a rapid disappearance of mercaptan with simultaneous absorption of oxygen. Recognizing this fact, reaction conditions can be so selected that a rapid sequence of reactions ensues which characterizes efficient inhibitor sweetening. As observed in Runs 5, 6 and 7 the combination of UOP No. 5 Inhibitor and caustic led to absorption of oxygen in amounts of about 0.4 mole per mole of mercaptan consumed, and formation of disulfides in yields varying from 55.5% to 64% of the mercaptan consumed. Refinery caustic was as suitable for use as the fresh 20% solution of sodium hydroxide. With each caustic, a small but detectable amount of peroxide was formed and remained at the end of the run.

As pointed out later, the reactions which ensue are in rather delicate balance, and the course of reaction can be altered by slight changes in the reactants. Thus, in the last run with *n*-butyl mercaptan (Run 8), the UOP No. 5 Inhibitor and caustic mixture was contacted with oxygen for 70 hrs. prior to addition of the mercaptan. The oxidation which ensued is characterized by incompleteness of mercaptan consumption, increased oxygen absorption, and decreased disulfide formation. These facts as observed indicate that the sweetening reaction is a sequence of steps and preoxidation of the inhibitor interferes with the normal sequence.

The discussion so far has considered sweetening of *n*-butyl mercaptan, which enters into the sweetening reactions with ease. The results with secondary - butyl mercaptan indicate that this compound does not undergo inhibitor sweetening with the same ease. As observed in Table 1, the results with *sec*-butyl mercaptan are characterized by incompleteness of reaction and increased oxygen consumption. However, the basic reactions involved with the *sec*-butyl isomer appear to be comparable to those which take place with the *n*-butyl isomer.

With *t*-butyl mercaptan, the sweetening reactions do not proceed to any great extent. As observed in Table 1, the results with this mercaptan are characterized by slowness of reaction, small mercaptan consumption, small disulfide formation, and large oxygen absorption. The inability to bring *t*-butyl mercaptan into reaction is due to its sluggishness, particularly in respect to that phase of reaction leading to disulfide formation.

It is impossible to bring about inhibitor sweetening with thiophenol. This material forms disulfides in the presence of basic materials, but will not undergo the reactions considered typical of inhibitor sweetening. The oxidation of thiophenol in the presence of olefins will be considered in a future publication.

Mechanism of Reaction

The next task is the formulation of a suitable scheme of reaction to account for all these observations and to reveal the significance of each reagent. This objective has been accomplished by considering the reactions as a two-step sequence. The over-all reaction is a composite of simultaneous reactions; no single reaction can account for the facts observed. In the first phase of the sequence, oxygen is absorbed by the olefin - mercaptan combination to form a peroxide, and the mercaptan is converted to a sulfide.

$$A:\ C{=}C + RSH + O_2 \rightarrow C(S{-}R){-}COOH$$

The oxide formed is reductively decomposed in the presence of a base by the mercaptan which forms the disulfide.

$$B:\ C(S{-}R){-}COOH + 2RSH \rightarrow C(S{-}R){-}COH + RSSR + H_2O$$

The over-all reaction is thus:

$$C{=}C + 3RSH + O_2 \rightarrow C(S{-}R){-}COH + RSSR + H_2O$$

This proposal is in agreement with the facts as observed. According to the over-all equation, it is calculated that 0.33 mole of oxygen is absorbed per mole of mercaptan consumed, and 67% of the mercaptan is converted to disulfides. Incomplete reduction of the peroxide intermediate, as made evident by the peroxide number of the sweetened hydrocarbon mixture, is one reason for the small deviations of the observed values from the theoretical.

The function of the UOP No. 5 Inhibitor is to tie these two reactions together by taking part in an alternating oxidation - reduction system. The cycle thus formed operates with mercaptan consumption in both steps.

Steps A and B represent the two reactions in general terms and form a basis upon which a further inquiry of the chemical factors can be made. A more thorough scrutiny reveals that a number of individual reactions are involved and these reactions can be integrated to form a logical explanation of the entire process. The sweetening process is believed to proceed via chain reactions and the chain carriers are free radicals.

The first phase of the reaction, Step A, is as follows:

$$RSH \rightarrow RS\bullet \qquad (1\text{-a})$$

$$RSH + \text{Oxidized No. 5 Inhibitor}^{*} \rightarrow RS\bullet + \text{No. 5 Inhibitor} \qquad (1\text{-b})$$

$$RS\bullet + C{=}C \rightarrow C(S{-}R){-}C\bullet \qquad (2)$$

$$C(S{-}R){-}C\bullet + O_2 \rightarrow C(S{-}R){-}COO\bullet \qquad (3)$$

TABLE 1—Inhibitor Sweetening of Butyl Mercaptans in Cyclohexene at 30° C.

Run	1	2	3	4	5	6	7[d]	8	9	10
Charge, weight in grams:										
Cyclohexene	12.921	13.011	12.210	16.182	11.841	11.823	17.270	11.824	12.180	12.094
Mercaptan	0.511	0.566	0.575	0.533	0.594	0.5775	0.590	0.555	0.553	0.548
Configuration	n	n	n	n	n	n	n	n	sec	t
UOP No. 5 Inhibitor				0.0422	0.0338	0.0426	0.0395	0.0341[c]	0.0446	0.0520
Caustic		0.0456[a]	0.0068[b]		0.0442[a]	0.0743[a]	0.0818[a]	0.0665[a]	0.0068[b]	0.0578[a]
Oxidation data:										
Duration of run, hours	72	48	48	95	24	24	24	25	26	25
Rate of oxygen absorption, moles O_2/mole RSH/hr.		0.007	0.014	?	0.06	0.02	0.07	0.035	0.06	?
Total absorption, moles O_2/mole RSH	0	0.14	0.23	0.24	0.42	0.38	0.42	0.56	0.47	0.25
O_2 absorbed as peroxide, %				0	2	2	1	0	0	
Mercaptan data:										
% remaining	93	39	3	68	0.5	1.5	0	21	21	81
% conversion to disulfide		59	93	?	64	55	64	27	42	3
Moles O_2 absorbed/mole RSH consumed		0.24	0.24	0.75	0.42	0.39	0.42	0.71	0.60	1.28
% RSH consumed to disulfide		98	95.5	25	64	55.5	64	34	53	16

a) Refinery caustic.
b) Solution of NaOH, 20 wt. %.
c) UOP No. 5 Inhibitor oxidized by oxygen in presence of caustic for 70 hrs. prior to mercaptan addition.
d) Run in absence of caustic insoluble, phenolic antioxidant.

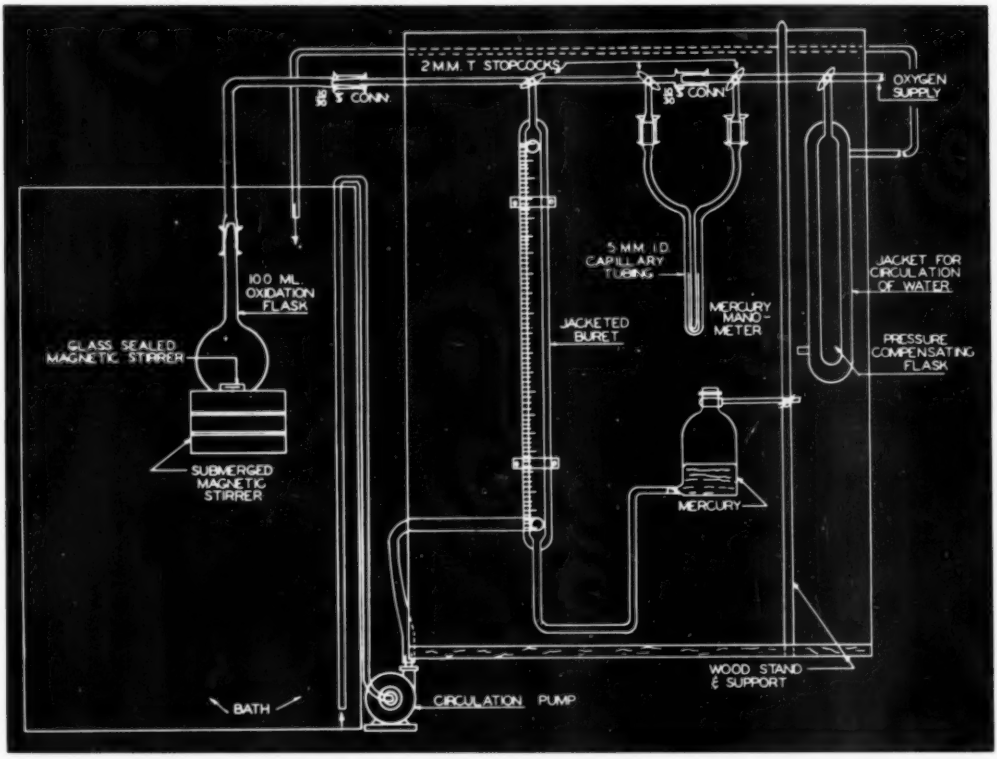


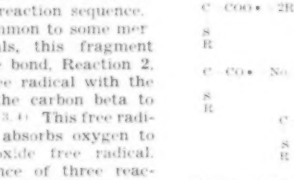
Fig. 2—Sketch of apparatus (constant-pressure type of manometer) used in the oxygen absorption studies made in the laboratories of Universal Oil Products while investigating inhibitor sweetening

The mercaptan RSH forms an alkyl mercapto free radical, RS•, in which the unshared single electron is signified by the dot. While RS• fragments can be formed by some direct means, (1-a), the main source of these fragments is due to the reaction of the mercaptan with oxidized UOP No. 5 Inhibitor, Reaction 1-b. The oxidized UOP No. 5 Inhibitor can and does occur by direct air oxidation[6, 9] but is also formed in the latter part of the reaction sequence.

In a manner common to some mercapto free radicals, this fragment adds to the double bond, Reaction 2, to form a new free radical with the active center on the carbon beta to the sulfide linkage.[3, 4] This free radical in Reaction 3 absorbs oxygen to form a hydroperoxide free radical. Thus by a sequence of three reactions, we have the essentials of Step A.

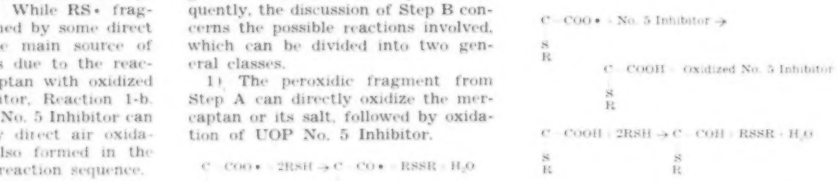
The reductive decomposition in Step B of the peroxide fragment leads to the formation of disulfides by oxidation of the mercaptan. As often is the case, the chain intermediates and the specific reactions they undergo are difficult to identify. Consequently, the discussion of Step B concerns the possible reactions involved, which can be divided into two general classes.

1) The peroxidic fragment from Step A can directly oxidize the mercaptan or its salt, followed by oxidation of UOP No. 5 Inhibitor.

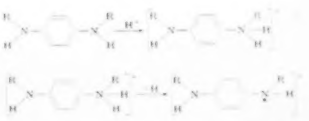


This oxidation depends on a sufficient stability of the intermediate so that this selective reaction occurs, and the mercaptan is brought into reaction in preference to other reactions which may take place.

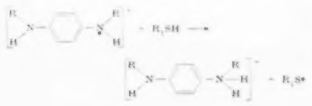
Another similar scheme, but in reverse order, is as follows:



In both schemes, UOP No. 5 Inhibitor is converted to the oxidized form by loss of an hydrogen atom. The oxidation of UOP No. 5 Inhibitor is conceived to involve the following reactions:

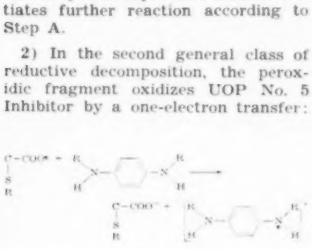


The N,N'-dialkyl-*p*-phenylene diamine adds a proton to form an ammonium complex, which in turn upon oxidation loses an hydrogen atom with formation of stable aminium free radical of the Wurster type.[8] This free radical can be reduced back by mercaptan or its salt as follows:

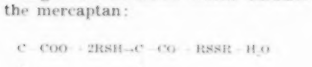


The alkyl mercapto free radical initiates further reaction according to Step A.

2) In the second general class of reductive decomposition, the peroxidic fragment oxidizes UOP No. 5 Inhibitor by a one-electron transfer:



The UOP No. 5 Inhibitor is converted to the foredescribed aminium free radical and the peroxidic fragment is changed to an anion which oxidizes the mercaptan:



This latter reaction can be compared to the hydrogen peroxide oxidation of mercaptan to disulfide in the presence of alkali.

In conclusion, this paper has submitted experimental data on the reactions involved in inhibitor sweetening, and has interpreted the results with a mechanism which fits the facts and is consistent with present theory. It is hoped that this discussion will assist in a better understanding of the sweetening process and increase its applicability.

Experimental Apparatus, Technique

The oxygen absorption studies were made in a constant-pressure type of manometer, the sketch of which is found in Fig. 2. The apparatus and procedure for its use are essentially that described in *Manometric Methods* by M. Dixon, The University Press, with modifications as needed for this particular work. Pressure-tight stopcocks were assured by use of the Hamilton Stopcock adapter. The mercaptan, olefin, inhibitor, and caustic were weighed, generally in this order, into the stoppered reaction flask previously flushed with oxygen. The flask, volume about 100 ml., was attached to the manometer assembly using a small amount of silicone stopcock grease on the joint. The assembly was placed adjacent to the constant temperature bath so that the reaction flask was located in the bath directly over a submerged enclosed motor-driven magnet which revolved a small glass-enclosed bar magnet in the reaction flask. The stirring so obtained avoided a static condition and was found sufficient.

The run was started with pressure in the entire assembly at atmospheric and the stopcocks were so arranged that the system was divided into two closed units by the mercury manometer. The absorption of oxygen in the reaction flask reduced the pressure in reference to that in the pressure compensating flask, thereby changing the levels in the mercury manometer. The mercury level in the 50 ml. buret was so adjusted that the pressures were equalized, and a reading was taken. From these readings were obtained the volume of gas absorbed at buret temperature (30° C.) and the atmospheric pressure at start of the run.

Each experiment except one was run in the presence of about 0.010 gram of a caustic insoluble, phenolic antioxidant in order to prevent any extensive oxidation which might have occurred in the absence of an inhibitor. The presence of this material did not fundamentally alter the course of reaction, as is made evident by examination of results from Run 7 (Table 1) made in the absence of this antioxidant.

At the end of each run, the contents of the flask were transferred to a volumetric flask and diluted to 100 ml. with benzene. Analysis for peroxides was made by the KI method. The pipetted sample was heated to reflux with 25 ml. of chloroform (40 vol. %), and acetic acid (60 vol. %) and 1 ml. of saturated KI solution. Precautions were taken to exclude air by working in an atmosphere of carbon dioxide. One hundred ml. of water was added and the liberated iodine was titrated with 0.005 N thiosulfate solution. The presence of UOP No. 5 Inhibitor often made determinations of end point difficult. The peroxides formed from 1 mole of absorbed oxygen will theoretically liberate 1 mole or 2 equivalents of iodine.

The analysis for disulfides was based on the reduction with zinc and caustic to mercaptan. The excess zinc was removed by filtration and the mercaptan was titrated potentiometrically.

A measured volume of solution containing about .00005 equivalents of mercaptans in the form of disulfides was pipetted into a 50 ml. Erlenmeyer flask equipped with a small air-driven stirrer. After the addition of 25 ml. of methyl alcohol, about 0.5 gram of zinc dust, and 2 ml. of Claisen solution (1 part KOH, 1 part water, 2 parts methyl alcohol), the solution was stirred for 15 minutes. One ml. of glacial acetic acid was added and stirring was continued for 5 minutes. The solution was filtered through a funnel consisting of a glass fritted plate (about 15 mm. in diameter) fitted onto a glass tube 30 mm. in outside diameter and 15 cm. long. Although the plate was of fine construction (No. 150), particles of zinc passed through unless a bed of powdered zinc coated the plate. In order to assist in the filtering, about 5 to 10 psi of air pressure was applied to the filtering funnel. The funnel was washed with 50 ml. of 0.1 N sodium acetate in ethyl alcohol and with methyl alcohol.

The titration was conducted according to UOP Method No. 4-163-40 [Tamele and Ryland, *Ind. Eng. Chem. Anal. Ed.* 8, 16 (1936)], using the equipment described by Lykken and Tummler [*Ibid.* 14 67 (1942)]. Titrations were made with 0.01 N silver nitrate in isopropanol.

The titration for mercaptan was made using the above procedure as described in the literature. It was found advantageous to add 5 to 10 drops of glacial acetic acid to the sodium acetate solution.

If mercaptans were present this titration value was subtracted from the disulfide titration to obtain a value for the disulfide content. In case of a large mercaptan content, it was found advantageous to remove the mercaptan prior to disulfide analysis by contacting with a 10% solution of silver nitrate. The gelatinous precipitate formed often made filtering impossible, so the sample was centrifuged at 1500 rpm. for 20 minutes, after which filtering was possible.

The solution of refinery caustic upon analysis was found to contain

Phenols, % by wt.	31.3
Thiophenol, % by wt.	2.7
Total alkalinity, calc. as % NaOH	18.7
Sulfide, calc. as % NaOH	.805
Mercaptide, calc. as % NaOH	.635

Bibliography

(1) Bond, D., *Oil Gas J.*, 44, 31, 83 (1945).
(2) Happel, J. and Cauley, S., *Ind. Eng. Chem.*, 39, 1655 (1947).
(3) Kharasch, M. and Fuchs, C., *J. Org. Chem.*, 13, 97 (1948).
(4) Kharasch, M., Read, A., and Mayo, F., *Chem. and Ind.*, 57, 752 (1938).
(5) Lachman, A., *Ind. Eng. Chem.*, 23, 354 (1931).
(6) LuValle, J., Glass, D., and Weissberger, A., *J. Am. Chem. Soc.* 70, 2223 (1948).
(7) Moriarty, F. C. and Johnstone, W. W., "Recent Developments in Petroleum Treating Procedures," presented before National Petroleum Association, Charleston, West Virginia, May 5, 1949.
(8) Sedgwick, N. V., "The Organic Chemistry of Nitrogen," Oxford: The Clarendon Press, 1937, page 98.
(9) Strickland, B., *Anal. Chem.*, 20, 551 (1948).
(10) Xan, J., Wilson, E., Roberts, L., and Horton, N., *J. Am. Chem. Soc.*, 63, 1139 (1941).

LOOK AT THAT PUMP! LEAKING LIKE A SIEVE IN LESS THAN A YEAR!
STEAM CONDENSATE RETURN
LOOK, BROTHER, PURE WATER IS CORROSIVE -- YOUR SPECS SAID YOU WANTED THIS PUMP TO HANDLE FEED WATER AND THAT ISN'T CORROSIVE!
CHUCK THURSTON

No. 3 in a series on How to Order Equipment

How to Get What You Need When You Order a Pump

By D. P. THORNTON, Jr., Southwestern Editor

PUMP manufacturers often receive queer documents from customers in the guise of specifications. They might be amusing if the potential consequences were not so serious and far-reaching. Some of the specifications are inadequate, misleading, erroneous or unnecessary.

Providing adequate information to enable the seller to intelligently quote or fill an order for pumps is just as vital as it was shown to be for valves in the first two articles of this series. Generally pumps are more expensive than valves and contain more critical materials; therefore, a failure or misapplication may prove more embarrassing.

The only way that advantage can be taken of a pump supplier's experience is to advise fully what the pump is expected to do. Frequently this is not brought out by the basic information which always must be furnished before the pump can be supplied at all.

There are four principal advantages in stating clearly what the pump must do with the liquid it is to handle.

1. The pump manufacturer can immediately determine whether or not his standard pump will perform satisfactorily. Perhaps he can suggest an alternate pump from the one the buyer specified, but still a "standard" item. Thereby both time and money will be saved and the purchaser is assured of satisfactory performance.

2. Perhaps the supplier can suggest rearrangements of affected facilities which will permit substitution of a "standard" pump for what otherwise would be a "custom job". Under today's conditions of materials allocations and factories busy with defense work, extremely long delivery dates may be avoided by accepting the "standard" item. The cost will be less, too.

3. The pump maker can double-check the buyer's selection of the correct pump as a precaution against a possible error, either of the technical kind or the typographical gremlin.

4. The manufacturer may be able to suggest pumping arrangements entirely different from the proposed, by taking advantage of his experience as well as frequent technological improvements in the pump design and application. It is said, for instance, that any centrifugal pump more than five years oil is technically obsolete and reportedly some 15 to 20 new pump designs have been introduced since 1945. The alternate suggested may be less expensive initially or more satisfactory in service.

A sales representative's favorite story illustrates this point rather spectacularly: The operator of a war-built plant complained to the pump supplier about poor service life in a large centrifugal pump battery. The plant had been built by an eastern contractor but, until the complaint was received, the pump supplier had no idea where his pumps had been installed or anything about the service other than the liquid handled and hydraulic heads involved.

It turned out the pumps were being rapidly cycled in on-off service; wear was extremely high. The sales engineer's suggestion was followed—run the pumps con-

Reprints Available on Valve Articles

Reprints have been prepared of the first two articles in this series on "How to Order Equipment"—July, pp. 722-24; August, pp. 844-47. They cover the subject of valves, both manually-operated and non-manually-operated. Single copies may be obtained without charge by writing:

PETROLEUM PROCESSING
1213 West Third St.
Cleveland 13, Ohio

Price quotations for quantities will be furnished on request.

tinuously and install valves so that the process controls, instead of cycling the pumps, would open and close a discharge valve. When the discharge valve was closed a by-pass valve would open between pump suction supply and discharge, and vice-versa. Service life and maintenance promptly became normal.

Another matter often may be lost sight of in writing purchase specifications for pumps. (It also applies equally to other types of refinery and gasoline plant equipment.) Whenever the buyer's specifications depart from what the manufacturer considers "standard," either in materials or design, the supplier will not guarantee the pump. This is because the manufacturer usually has little or no familiarity with such materials in the particular service involved on which he can base a guarantee, and hence the buyer has no come-back if it proves unsatisfactory.

These, and others, are the reasons behind the supplier's desire to know what the pump is supposed to do. This is why he often must perform all sorts of "Sherlocking" and sometimes gaze deeply into his crystal ball.

Make Experience Data Available

It is always helpful to the supplier if the buyer will pass along any experience he may have had with specific types of pumps or materials in the service contemplated. Negative as well as positive information is helpful, for the supplier adds this to his experience lore and is thus "paid" for the "free engineering" passed on to the buyer in his recommendations.

One manufacturer illustrates this by taking the San Francisco Bay area as a practical example, where numerous industries use sea - water for cooling purposes. The Bay likewise is a depository for all sorts of domestic and industrial waste effluents. He customarily supplies no less than five different pump trims for handling this water, depending on the location; for all practical purposes the temperature and specific gravity are the same.

There are points where the Bay water will not affect an ordinary cast iron pump. There are others where monel trim is required and some where nickel-chromium and other corrosion-resistant alloys are required. Obviously this manufacturer insists on knowing not only the capacity and head requirements for the pump, but also from what part of the Bay the sea-water is withdrawn; the mere statement that "Bay-water" is the liquid handled would be unacceptable if the pump is supplied with a guarantee.

A similar situation exists along the Gulf Coast.

An apparently common buyer misconception about centrifugal pumps is that they handle a certain number of gallons per minute at so many pounds per square inch pressure. This is not true. A pump moves pounds per hour of liquid through a specified hydraulic gradient. The required maximum discharge head in feet of liquid or its equivalent must be specified; namely, the distance in feet, vertically, from the center of the point of free discharge for the liquid under consideration, including due allowance for pipe friction from pump to discharge. The suction head, hydraulic gradient from point of supply to the centerline of the pump nozzle, corrected for vapor pressure, velocity head and friction losses, also must be known.

This is not as important with reciprocating pumps, excepting the suction head, because capacity is fixed by piston displacement and speed while discharge pressure is limited only by the materials of which the pump is made and the maximum power of the driver. From the design standpoint, however, hydraulic gradient must be used.

Another common misconception about centrifugal pumps is that they supply design head at all times. This is not true. The pump handles only what it meets in the system; the performance is quite elastic. Inspection of pump performance curves will show that, as quantity delivered increases, the discharged head (pressure) drops, and vice-versa. Capacity is limited by suction conditions and what the casing will handle as well as restrictions in the discharge line away from the pump. Capacity also is proportional to speed while the power requirement is affected both by the capacity being handled and the speed. All these characteristics are curved rather than straight lines.

The buyer still may "go wrong," as illustrated by the following example taken from the files of a manufacturer's agent in Houston.

An invitation to bid received from a large oil company correctly described a reciprocating pump, a standard item in every respect. However, the invitation also disclosed the quantity to be pumped and gave the power rating of the buyer's driver. From this it was apparent that the prospective purchaser intended to operate the pump at a considerably higher speed than recommended by the manufacturer. Experience indicated this would sharply reduce the service life of the pump, meanwhile predisposing the installation to excessive maintenance costs.

The agent quoted on the pump specified, but advised that overspeeding would be required to meet specified capacity and detailed the probable consequences. He also quoted on another pump, which his judgment indicated is actually the best for the proposed service.

It is debatable whether or not the prospective buyer realized or overlooked the consequences in overspeeding the pump; he simply may have been trying to reduce capital investment. Nevertheless, supplying all the facts gave the equipment supplier the opportunity to make an intelligent recommendation. Otherwise, these circumstances might not have come to light until a complaint was received on the pump life.

Specification Trouble-Makers

A common trouble-maker is the invitation to quote which does not specify required trim and gives little or no information on service conditions; it may call for a quotation by catalog number. Later, when the quotation has been accepted, the buyer appends a statement to his purchase order to the effect that " . . . we

Don't Forget the Human Element

Even though you give your supplier all the information he needs when you order a replacement part, you won't get what you need if you don't give him the *correct* information.

The field purchasing agent for a large oil company wired a supply-house to "Airmail Part No. 25 shaft nut for centrifugal pump Serial No. 2769473." It so happened the serial number designated a reciprocating pump, not a centrifugal. To make it worse, Part No. 25 for the centrifugal the supply house thought might be involved was not a shaft nut.

The circumstances called for two more telegrams and an unknown number of telephone calls—and the part's receipt was delayed nearly 48 hours. The purchasing agent had acted on the only information he had, and it was necessary to refer the matter back to the field superintendent.

--SAYS HE WANTS A QUOTE ON A 100 GPM CENTRIFUGAL PUMP TO HANDLE "SALT-WATER AT 80°F AND 100 PSI"
GOOD! WHAT SPECIFIC GRAVITY??? DRIVER SPEED AND DIRECTIONS??? NDSH??? CAST IRON OKAY???
CHIEF QUOTER

assume you will supply 'X' trim or the like.

From the original information on which the quotation and implied recommendation was based, neither agent nor manufacturer knows whether the buyer "really needs special trim or just thinks it would be a good idea." Special trims generally are furnished at extra cost and, consequently, the supplier has the alternatives of refusing the order, accepting it and losing money, or entering into what may be extensive negotiations by letter, telephone or personal visits to settle the matter. Unnecessary delays and annoyance for the buyer are inevitable, for which he has only himself to blame.

Another source of difficulty is due to a widespread misunderstanding of the term "NPSH," or net positive suction head. It is defined as the gage pressure at the centerline of the pump (eye of impeller on centrifugal pumps and where top suction connections are used, otherwise center of suction nozzle) *minus* the gage vapor pressure of the liquid at flowing temperature, all expressed as feet of liquid, *plus* the velocity head (distance from pump centerline to surface of suction supply) in feet. It is recommended that buyers advise both "NPSH" and suction head, or suction lift, as the case may require.

Some specifications received by pump suppliers, often a part of invitations to quote, are unnecessarily complex. They give the impression that the buyer believes he knows more about pump design than the manufacturers. These go into the type and location of bearings, casing materials, clearances between rotating and stationary parts, the number of rings on pistons, and so on. It is not unusual to find quoted whole sections from various society standards and codes.

Several oil companies have adopted standards of their own for various equipment items. Some of these are excellent, but others tend to become ironclad, may be infrequently amended and give evidence of not taking advantage of technological improvements which makers have built into their pumps. Admittedly it is difficult for customers to stay abreast of constant improvements in pump design and application developments. That is why most equipment manufacturers maintain customer service departments, have a host of sales engineers and constantly advertise their products in numerous ways.

A common objection is that these detailed specifications frequently call for the use of certain materials, with the apparent purpose being, for example, corrosion-resistance.

These materials may be excellent for a single consideration such as corrosion resistance, manufacturers say, but on the other hand they often introduce serious mechanical, design and fabrication problems.

Another objection is that, to follow these specifications to the letter, a manufacturer would be obliged to design a special line of pumps, entirely separate from his standard line. This is improbable and the supplier either must refuse the business or write a countering proposal taking exceptions; this impressive document may be even longer than the original specification. Where departures from his standard pump may not be extensive, the maker may quote and also suggest an alternate, the latter perhaps only slightly modified from his standard line. In the long run, the buyer usually decides to take the near-standard instead of the "special".

Data required when ordering pumps

Although it is not within the scope of this article to discuss the selection of pumps, the manufacturers of centrifugal pumps pass along one suggestion which can be a money-saver. If possible, accept the highest speed available in selecting a centrifugal pump. In general, the higher the speed, the lower the first cost. Maintenance cost will be about the same as for the slower speed unless abrasive liquids are being handled, and the pump will be considerably smaller although the horsepower requirement will not be greatly different. However, manufacturers suggest that, whenever possible, speed not be specified. This gives the manufacturer the maximum latitude in selecting the pump best suited to the operation.

The listing of information required in ordering pumps assumes that the buyer has correctly chosen the type of pump required for his service—reciprocating, centrifugal, gear, or other rotary, positive-displacement design. If there are doubts, there are many articles available in the literature and manufacturers' publications to aid in selection, manufacturers, their sales representatives and equipment supply houses always are glad to advise a prospective buyer's engineers and purchasing agents.

In contrast to the subject of valves, treated in the preceding two articles, the following is required for ordering all pumps, regardless of type:

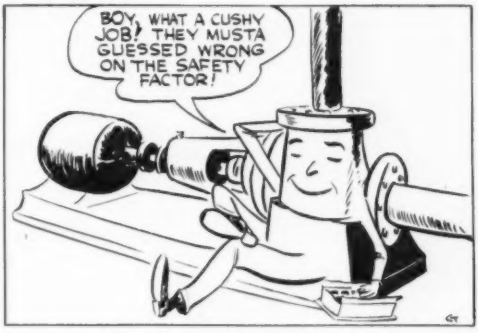
1. Maximum and operating capacities, gpm. (So pump can be selected to give highest efficiency under normal operating conditions, even though the maximum capacity specified may be much higher for safety or standby consideration.)
2. Nature of liquid to be pumped. (This may be disclosed by name, if pure, or statement of physical characteristics including: specific gravity or density, viscosity and vapor pressure, under service conditions. A chemical analysis is very helpful if accurate and from a representative sample.)
3. Corrosive and or abrasive characteristics of liquid. (This is needed in deciding on trim and possibly speed. Don't guess on abrasive characteristics. Trim of pumps giving satisfactory service is desirable information, or data on materials known to resist these conditions.)
4. Temperature of the flowing liquid. (Under service conditions. If special requirements are needed on start-ups advise start-up temperatures also.)
5. Discharge pressure, psig, or feet head of liquid. (Manufacturer will assume pressure is for pump discharge nozzle unless otherwise specified.)
6. Suction Head. Advise:
   a. Suction pressure. (Gage pressure if supply is *above* pump, suction lift if supply *below* pump. Express both in feet head of liquid at flowing temperature.)
   b. Net positive suction head. (Feet head of liquid over and above vapor pressure at flowing temperature and design maximum capacity, between liquid surface and pump centerline. This should not be determined under static, or no flow, conditions.)
   c. If liquid level is variable, advise extent.

7. Size of suction and discharge pipe; type of connection required (screwed, flanged, type of flange and facing, etc.).

8. Type of pump. (Centrifugal, reciprocating, rotary, etc.) (Advise preference as to horizontally or vertically-split casing. If vertical split specify top or end suction preference. If reciprocating advise whether plate or pot valve preferred, and piston or plunger type.)

9. If *buyer* is to supply driver, advise:
   a. Type of drive — direct or belt; give flexible coupling preference, if any.
   b. Specify if driver to be mounted by supplier.
   c. Describe driver: engine, turbine, motor, make, model, number.
      1) Shaft size.
      2) Available horsepower.
      3) Speed and direction of rotation.

10. If *manufacturer* is to supply driver, advise:
   a. Preference: steam turbine, electric motor, internal combustion engine.
   b. If turbine, give steam pressure, quality or superheat and exhaust pressure.
   c. If motor, advise current characteristics. Be sure to specify whether explosion-proof, totally enclosed, splashproof or open type required.
   d. If engine, state nature of fuel, quantity and pressure available, cooling water temperature and volume available.



11. Pump service. (Continuous, intermittent; boiler feed, cooling water, hot oil, debutanizer reflux, etc. Suggestion: Give full details, even to piping diagrams and scale drawings for unusual applications and "custom" pump designs.)

12. If buyer has previous experience in application, state details on those pumps which have proven satisfactory, as well as on those which have not.

Data required when ordering pump parts

It is customary for most manufacturers to provide pump performance data and a parts list in the shipping crate with a new pump. These often are lost or buried in a file, but the parts list always gives specific information on ordering parts and should be consulted carefully.

Because of this common situation, and for other reasons, manufacturers generally keep individual records on each pump they supply by serial number, usually cross - indexed to customer's order number, company name and in other ways. Usually from these records the complete history of the pump as far as the manufacturer knows it, even to parts ordered through the years, is included.

Many manufacturers have standardized their various lines, too, for various types of pumps, so that the impeller nut for a centrifugal pump, for example, may have the same part number for dozens of different sizes and designs. Although this has been done to simplify parts ordering, it always is advisable not only to give the part number, but name the desired part. This is a safety precaution and possible time-saver, particularly when a part is needed in a hurry.

Required information:

1. Type of pump.
2. Pump Serial number. (This is extremely important.)
3. Part number and name; otherwise good description.
4. If available, purchase order number and date when pump was purchased.
5. When ordering driver parts from pump supplier, when supplier furnished driver, give type and serial number of pump, also. Generally, the manufacturer's records are indexed under the pump serial number.

How to Make Your Pump Supplier Unhappy—and Then Happy

Illustrating what to do and not to do in supplying basic information when requesting pump quotations are the following examples, recently received by a manufacturer's representative in Dallas:

A small natural gasoline plant requested a quotation on a pump to handle a specified volume of "salt water" at 70° F. and a given discharge pressure in pounds per square inch. The pump was to be driven by the buyer's engine through V-belts. Balance of the inquiry asked about delivery dates but contained no additional service data.

The prospective supplier could only guess at the pump required and had to request the following supplementary information: specific gravity of salt solution; if corrosive; if abrasives or solids might be present; a chemical analysis of the liquid, if available; suction pressure available or vertical distance in feet between pump location and salt solution level.

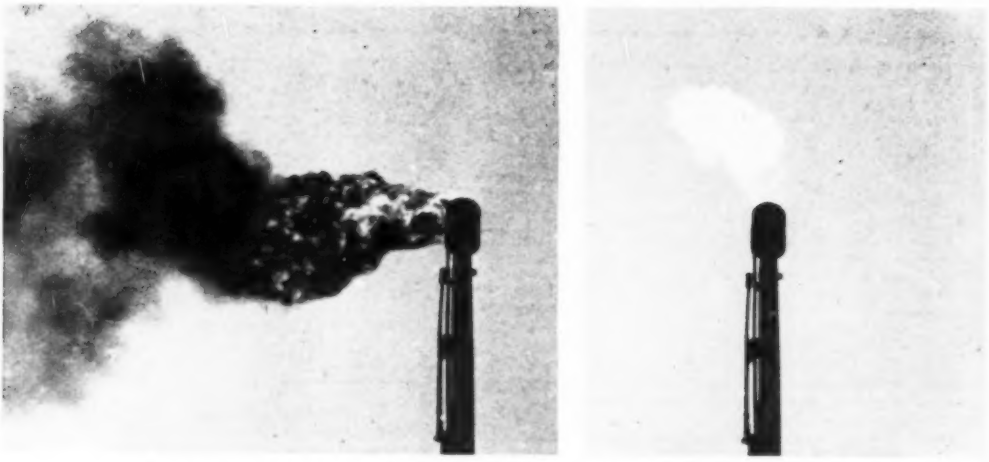
He suggested that V-belt drive was impractical because (1) at least 50 V-belts would be needed to transmit the required horsepower, considering the probable sizes of driver and driven pulleys, and (2) a speed-increaser would likely be needed since a high-speed pump would be required.

Another company also asked for quotations for a pump to handle salt water. Its letter stated available suction and required discharge heads in feet, specific gravity and flowing temperature of liquid and quantity to be handled. A complete chemical analysis of the salt water was given. Other solids were stated as not present.

The supplier was asked to recommend the most desirable trim and also to consider supplying a cast-iron body pump with the idea that it might be cheaper to discard that pump than repair it, or to buy a pump suitably trimmed for long life.

Quotations for two standard pumps, one alloy trimmed and the other of cast iron, were mailed that afternoon.

Moral: He who gives complete information, receives in reply a rapid quotation.



Smoke abatement effect by use of steam injection vividly shown in two views of one type of experimental flare

Smokeless Flare Stacks

Steam injection technique provides inexpensive and successful answer to air pollution problem

By ***WARREN H. SMOLEN***

Esso Standard Oil Co.

ATMOSPHERIC pollution due to smoke from flare stacks at Esso Standard Oil Co.'s Bayway, N. J., refinery, will be eliminated by the use of a steam injection system, employing relatively simple and inexpensive equipment. In addition to smoke reduction, the technique will provide a flame of very low luminosity, which will be advantageous for possible wartime security blackouts.

The arrangement for the smokeless plant flare stack is shown in the drawings in Fig. 1. Steam is injected through an open pipe into the center of the stack just below the top. The difference in appearance of the flare before and after installation of the steam injection system is vividly demonstrated in the pair of photographs at the top of this page, showing one form of experimental flare burning 20,000 SCFH of refinery gas.

Quantity of steam required varies with the quantity and quality of the gas being burned. For a waste gas stream of which approximately 8.5% of the combustible material is unsaturated, smoke was eliminated by injecting 0.25 to 0.40 lb. of steam per lb. of combustible material. Steam requirements increase with the degree of unsaturation. Steam injection also reduces the flame length to about $\frac{1}{5}$ its former size and greatly reduces its luminosity. The steam does not extinguish the flame nor does it have a deleterious effect on the flare tip.

The steam injection method was selected after a comprehensive test program to determine the most suitable method for eliminating flare stack smoke at Bayway. Test facilities were installed on an existing 60-ft. flare to inject measured quantities of steam at either the base or the top of the stack, and water through a spray nozzle at the top. In addition, steam atomizing water sprays were installed on a 200-ft. flare. The most effective method was

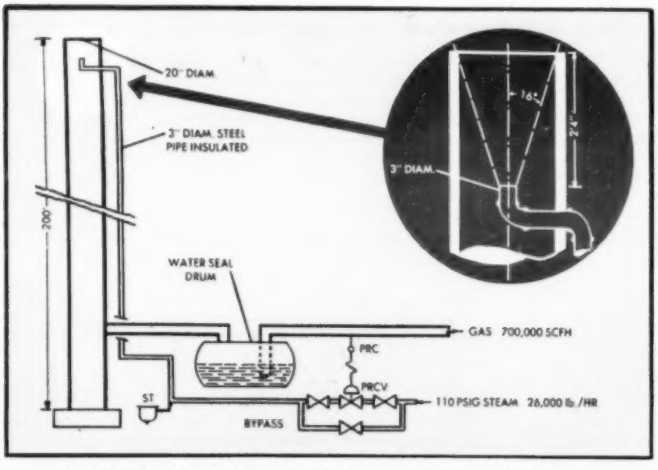
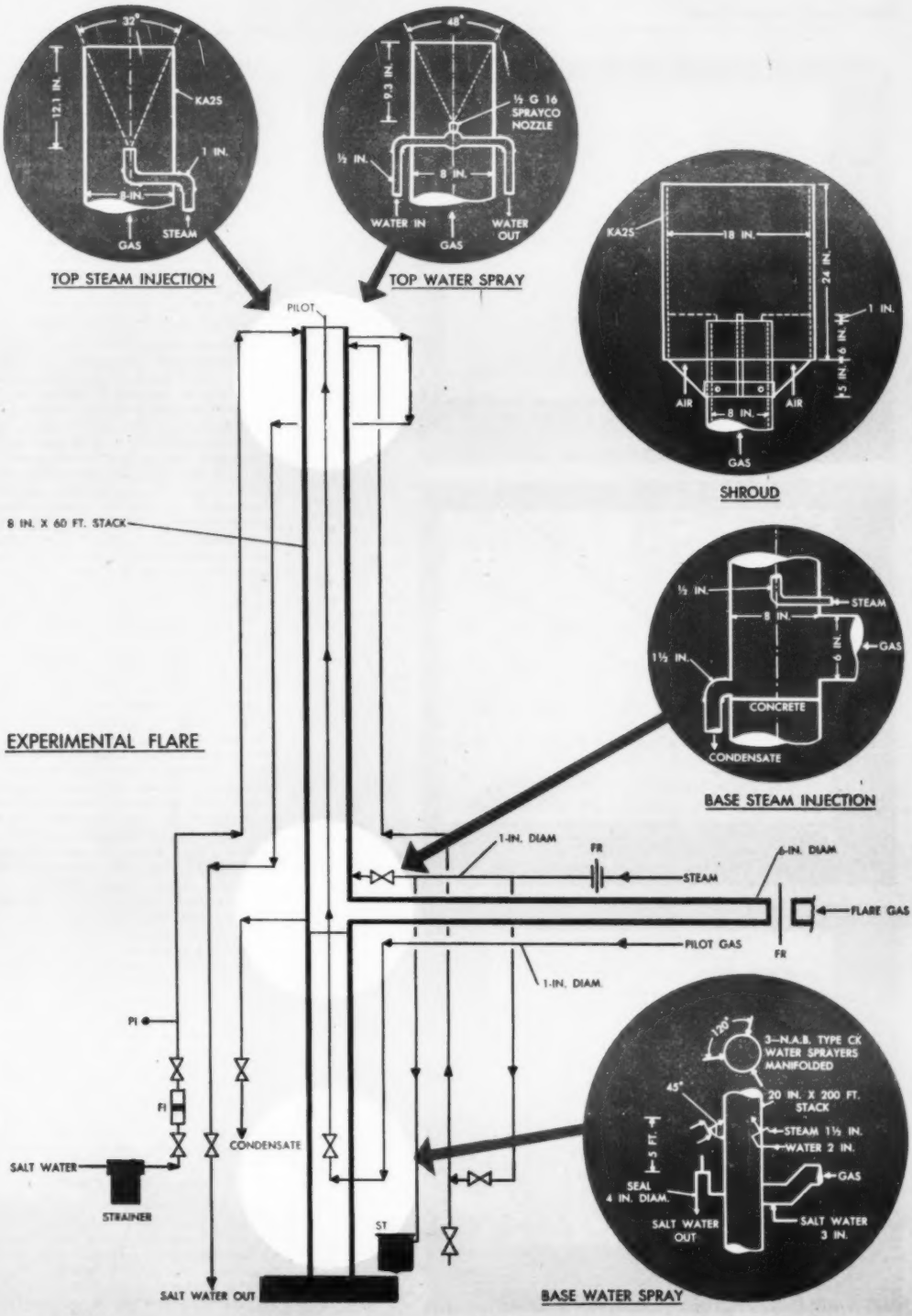


Fig. 1—Plant scale smokeless flare as installed in a 200-ft. stack

Fig. 2—(Opposite page) Test facilities at Bayway used in Esso's smoke abatement program


32°
12.1 IN.
KA2S
1 IN.
8 IN.
GAS
STEAM
TOP STEAM INJECTION
48°
9.3 IN.
½ G 16 SPRAYCO NOZZLE
½ IN.
8 IN.
WATER IN
GAS
WATER OUT
TOP WATER SPRAY
KA2S
18 IN.
24 IN.
1 IN.
5 IN.
6 IN.
AIR
AIR
8 IN.
GAS
SHROUD
PILOT
8 IN. X 60 FT. STACK
½ IN.
STEAM
8 IN.
1½ IN.
6 IN.
GAS
CONCRETE
CONDENSATE
BASE STEAM INJECTION
EXPERIMENTAL FLARE
1-IN. DIAM
FR
STEAM
6-IN. DIAM
FLARE GAS
PILOT GAS
FR
1-IN. DIAM.
PI
FI
CONDENSATE
SALT WATER
STRAINER
ST
SALT WATER OUT
120°
3—N.A.B. TYPE CX WATER SPRAYERS MANIFOLDED
45°
20 IN. X 200 FT. STACK
STEAM 1½ IN.
WATER 2 IN.
5 FT.
GAS
SEAL 4 IN. DIAM.
SALT WATER OUT
SALT WATER 3 IN.
BASE WATER SPRAY

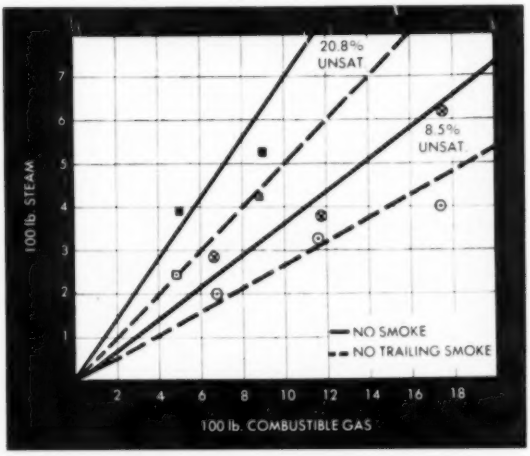


Fig. 3 — Top steam consumption

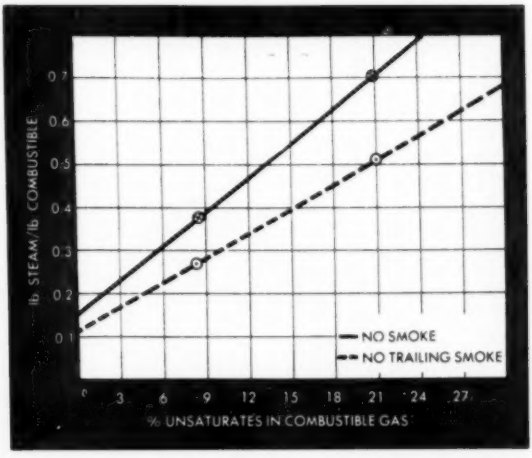


Fig. 4 — Effect of unsaturation on steam consumption

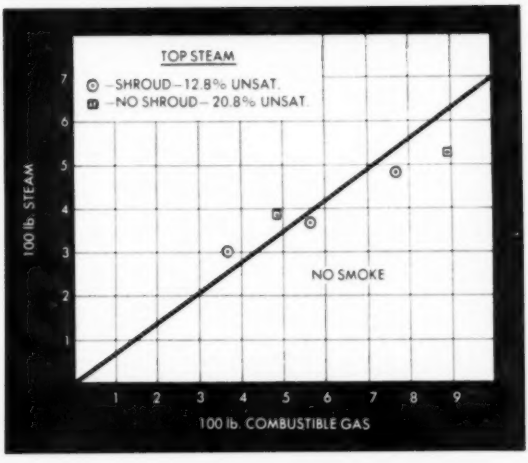


Fig. 5 — Use of a shroud with top steam injection

the steam injection at the top.

Other methods also proved unsatisfactory. The use of a cylindrical shroud to inspirate air at the top of the stack was ineffective by itself, and no appreciable reduction in steam requirements resulted from its use in conjunction with steam injection. Trial runs with steam injection at the base of the flare eliminated smoke satisfactorily; however, steam consumption was greatly in excess of that required at the flare tip. Water sprays were not effective in eliminating smoke.

Theory of Flare Operation

Refinery safety flares usually operate at close to atmospheric pressure. In the conventional type of open top flare stack, the gas is ignited as it reaches the top and before there is an opportunity for mixing with the proper amount of air for complete combustion. Part of the gas burns immediately, the oxygen deficiency inducing carbon formation, especially in the combustion of olefins. The unburned gases crack to form smaller olefins and paraffins and, under severe conditions, carbon and hydrogen. At the same time some molecules polymerize to form long chain hydrocarbons. Combustion of these compounds in a reducing atmosphere produces additional carbon. The long luminous flame evident in ordinary flaring is made up of incandescent carbon particles, which form smoke on cooling.

Steam suppresses carbon formation in two ways. By mixing steam with the gas before ignition, the hydrocarbon molecules are separated by the steam, thereby minimizing polymerization. At the same time, oxygenated compounds are formed which burn at a reduced rate and temperature not conducive to cracking and polymerization. The absence of incandescent carbon also gives the appearance of a shorter flame length. This concept of the effect of steam on smokeless burning has been derived not only from the results of Bayway experimental work but also from results of investigations of the pyrolysis of hydrocarbons. (See bibliography).

The idea of injecting steam or water into flares was originated at Esso's refinery in Everett, Mass. A steam injection flare of the ground burning type, similar in basic design to the new unit for elevated flares, has been in service at Everett for some time. Esso has not yet put any steam injection device into service on a full-scale plant flare in its refineries.

Experimental Flare

An 8-in. diameter by 60-ft. stack, formerly used as an emergency flare for the refinery gas plant, was adapted for the test program. Orifice meters were installed to measure the flow of absorber exit gas to the flare and the flow of steam to nozzles lo-

cated at both the base and the top of the stack. Salt water at 50-70 psig. was fed to a spray nozzle at the top of the stack through a rotameter. Facilities for the test program are shown in Fig. 2.

While flow control of all streams was provided, it was not feasible to regulate the quality of the gas being flared. Analyses of gas samples taken during the test provided data for formulating correlations. A pilot flame, ignited by hoisting a traveling torch, was maintained during each test.

Steam Injection at Top

Steam was injected into the center of the experimental stack through an open nozzle one ft. below the top, while burning 20,000 SCFH of gas. With injection at the rate of 400 lb./hr., all of the trailing smoke disappeared leaving a much shorter flame. As steam rate was increased to 630 lb./hr., all smoke disappeared, leaving a short colorless flame.

Data were obtained at various gas rates using gases containing 75-77 vol.-% combustible matter, the specific gravity of which varied from 0.7 to 1.4. Steam requirements increased with the quantity, molecular weight, and degree of unsaturation of the combustible burned.

As may be seen in the chart, Fig. 3, steam consumption for a gas containing 20.8% unsaturates in the combustible was much greater than that required for 8.5% unsaturates for equal degrees of smokelessness. The available data are inadequate for determining a firm correlation between the degree of unsaturation and steam consumption. However, a plot of the available data in Fig. 4, indicates that the presence of unsaturates in the gas stream requires additional steam to suppress carbon formation.

From these studies it was concluded that 0.1 to 0.2 lb. of steam per lb. of saturated combustibles is required to eliminate smoke at elevated flares. Incremental steam is required based on the degree of unsaturation, increasing to 0.5-0.8 lb. steam per lb. of combustible for a gas containing approximately 20% unsaturates.

A cylindrical shroud installed at the top of the stack (Fig. 2.) proved ineffective by itself. However, smoke was eliminated by injecting steam. Use of the shroud did not reduce steam requirements. The steam needed to eliminate smoke when using the shroud and burning a gas in which 12.8% of the combustible was unsaturated was approximately the same as that required when a 20.8% unsaturate gas was burned without the shroud, as shown in Fig. 5

It was concluded that no advantage could be realized by the use of the shroud. On the contrary, its use would probably create a safety hazard, because the gas also burned at the bottom of the shroud at steam rates less than about 300 lb. hr.

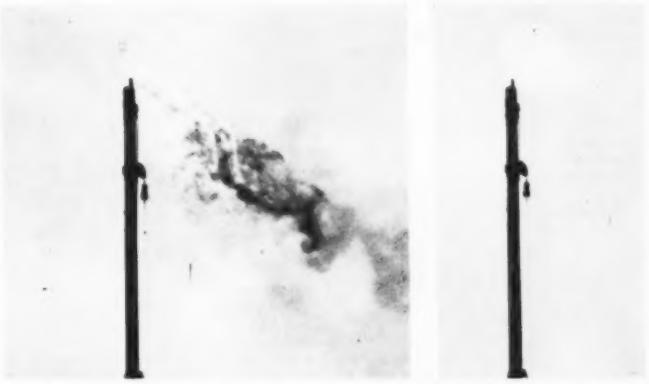


Fig. 6—Bottom vs. top steam injection with 20,000 SCFH gas flow. Left: bottom steam at 780 lb. hr.; right, top steam at 630 lb./hr.

Flame Luminosity

The major portion of the light given off by the flare flame emanates from incandescent carbon particles. By eliminating this carbon, a much shorter and relatively non-luminous flame results. This was evident in the daytime when steam was injected at the top of the flare. The flame could be made almost invisible by adding 150-200% of the steam required to eliminate smoke.

Flare luminosity assumes added importance during periods of national emergency because of the possibility of wartime security blackouts. An additional incentive for reduction of luminosity is the fact that the radiation is lessened. Coupled with lower radiation is lower combustion temperature due to steam injection, both contributing to longer flare tip life and decreased maintenance problems.

Steam Injection at Base of Experimental Flare

It would be desirable to install smoke abatement facilities at the base rather than the top of elevated flares to help maintenance and simplify installation at existing flares. Test arrangement for trying out this idea is also illustrated in Fig. 2. A comparison of bottom vs. top steam injection at similar gas and steam rates is illustrated in Fig. 6.

Smoke was eliminated by injecting steam at the base of the stack, but steam consumption was at least $2\frac{1}{2}$ times that required at the top for equivalent degrees of smoklessness, as shown in Fig. 7. The incremental steam consumption probably represents condensation loss, since a large

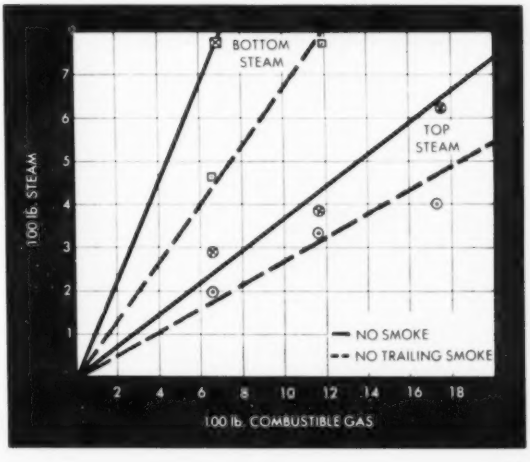


Fig. 7—Top vs. bottom steam injection

quantity of condensate was removed from the bottom of the stack when injecting steam at the base. This loss in efficiency would probably be magnified if applied to a 200 to 250-ft. stack.

An additional disadvantage for base injection is the problem of thermal expansion of the stack. Heating and cooling cycles develop internal strains, especially in the case of stacks supported rigidly by derricks, and also dislodge scale to plug up the stack bottom.

Water Spray at Top of Experimental Flare

Water sprays have proved successful in eliminating smoke when burning gases in pot type ground flares. Since a water spray would probably be more economical than high pressure steam, an attempt was made to eliminate smoke at the experimental flare by spraying water through a 1/2G16 Sprayco "Fulljet" spray nozzle, located 9.3 in. below the top. Fine atomization was obtained at 65 psig. and a flow rate of 242 gal./hr.

The spray was ineffective, however, in eliminating smoke at the experimental flare. In tests, it was observed that the water spray passed out of the flame zone without vaporizing or mixing intimately with the burning gases, even though it was finally atomized. Several other problems were evident. The nozzle would become plugged with scale formed in the water line at the top of the stack. It was necessary to install a return system which would permit continuous water flow to bypass the spray nozzle. A valve at the ground level outlet would be closed when a water spray was desired.

While the existing main pressure was adequate for the 60-ft. flare, it would be necessary to use a booster pump for a full-scale 200 to 250-ft. stack. The rain created by the spray in the vicinity of the stack was objectionable during the tests. Over a period of time, it would probably cause severe corrosion at nearby structures.

Water Spray at Base of 200-ft. Flare

Bayway's 200-ft., 20-in. diameter flare stack is connected in parallel with a 250-ft., 24-in., flare stack. The gas line to the 200-ft. stack contains an orifice plate to equalize the gas flow between the flares. During large releases of gas, however, it was noticed that the 250-ft. stack produced more smoke than the shorter stack. It was determined that at these flaring rates, the linear velocity in the shorter stack was sufficient to cause water to be entrained from the seal at the base of the stack, while the velocity in the taller flare was inadequate for entrainment.

In an effort to reduce this smoke at the 200-ft. flare, steam atomizing water sprays were installed at the base. However, they were ineffective in reducing smoke at gas rates below the velocity required for entrainment, and were only moderately effective in reducing smoke at high gas rates. It has been decided not to use these sprays except during periods when it is necessary to flare large quantities of gas for an extended period of time.

Plant Scale Smokeless Flare

The design of facilities for steam injection at the top of a flare will vary with the steam supply available and the flare service. It is not practical to design for the maximum capacity of the flare, because this would result in poor efficiency most of the time when gas rates would probably be much lower. On the other hand, it would be advantageous to tie in to several steam sources in order to use whatever surplus steam might be available during emergencies when large steam volumes are definitely needed for smokeless burning.

To provide complete mixing of steam and gas before they reach the top of the stack and at the same time minimize condensation within the stack, the top of the flare nozzle should be located at a point below the top of the flare such that the angle between the vertical and a line drawn between the nozzle and the flare tip is equal to 16°. The steam line should be insulated throughout and provision made for its expansion and contraction. Fig. 1 is the design for a typical elevated smokeless flare. No deleterious effect was noticed while using a KA2S flare tip at the experimental flare. However, Inconel has been widely recommended for flare tips.

Automatic control of the steam injection facilities may be troublesome because the use of a restriction in the gas line is unsafe and gas line pressures are normally very low. However, the use of a sensitive pressure controller on the gas line to open a control valve on the steam when the gas flow reaches a certain rate might prove satisfactory. A manually operated valve would permit adjustment of the steam flow when the control valve is open, and a bypass around the control valve would permit some flow of steam while the control valve is closed.

While sufficient data and experience have been obtained at the experimental flare for the design of steam injection facilities for a full-scale plant flare, it is believed that the design may be improved as a result of experience obtained in plant operations. It is, therefore, planned to follow closely the operations of the smokeless plant flares as they are put into service.

No experience has been obtained in the operation of a system to regulate steam flow in proportion to the gas. A control system has been devised for the first plant flare installation, but additional development work will probably be required.

Bibliography

1. Lang, J. W., "The Pyrolysis of Propane in the Presence of Water Vapor," 1935.*
2. Witham, W. C., "A Study of the Pyrolysis of Normal Butane with Steam," 1934.*
3. Munday, J. C., "The Thermal Decomposition of Normal Pentane," 1934.*
4. Groll, "Vapor Phase Cracking," *Ind. & Engrg. Chem.*, Vol. 25, pp. 784-98, 1933.
5. Parker and Wolfhard, "Carbon Formation in Flames," *Journal of the Chemical Society*, August, 1950, pp. 2038-49.
6. Perry, "Luminous Flame Burners," Chemical Engrs. Handbook, 3rd Ed., 1950, p. 1595.
7. Longwell, J. P., "Methods of Reducing Size and Luminosity of Propane Dewaxing Unit Flare," Standard Oil Development Co. letter dated Oct. 20, 1949.

* Dissertation submitted in partial fulfillment of the requirements for the Ph. D. degree in the faculty of pure science at Columbia University.

Illustrations

The photographs accompanying this article were furnished through the courtesy of Esso Standard Oil Co., and were taken by C. W. Dittemer, Bayway Engrg. Dept. refinery photographer.

Meet the Author

Mr. Smolen

Warren H. Smolen, a design engineer in Esso Standard Oil Co.'s Bayway, N. J., refinery, is a native-born New Yorker. He received a B. S. in Chemical Engineering from Michigan State in 1943 and immediately entered military service. He served in both the Pacific and European theaters with the rank of Lieutenant in the U. S. Army Corps of Engineers.

In 1946, Mr. Smolen joined Esso as an engineer in the Bayway refinery operations analysis department. Initial service in this position dealt with conservation and pollution problems. At present, his duties cover design work dealing with the construction of new equipment at Bayway.

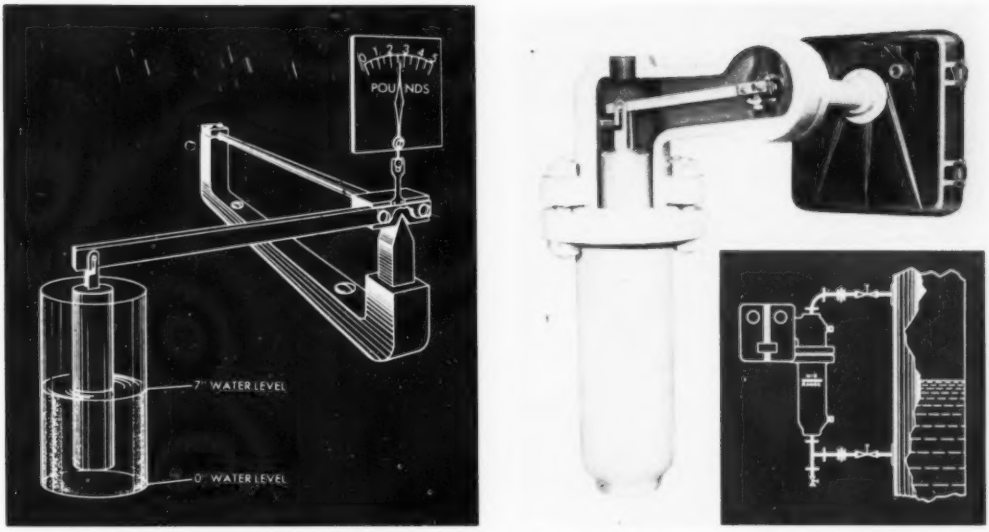


Fig. 19—Liquid level detection by variable displacement meter

REFINERY INSTRUMENTS

What Makes Them Tick?

Part 3—Liquid Level Measurement

By ***CORNELIUS E. SHANNAHAN***
Instrument Engineer
M. W. Kellogg Co., New York

THERE are many ways of measuring and controlling liquid level in petroleum processing operations, but by far the most widely used methods are through variable displacement and ball float type instruments. Because of its greater sensitivity to changes in level, and also because in most cases it is more trouble-free, the variable displacer type liquid level device is the more desirable of the two.

This instrument utilizes the theory that when a body is immersed in a liquid it loses weight equal to the weight of the liquid displaced. If a displacer weighing 5.1 lb., 10 in. long, and with a cross-sectional area of 10 sq. in. is immersed in 7 in. of water, the displacer weight becomes approximately 2.6 lb.

If a spring scale is attached to the displacer, the scale reading will be directly proportional to the increase of level. The travel of the displacer will also be proportional to the increase of level, and the magnitude of travel will depend upon the range of the spring scale.

For example, the displacer travel

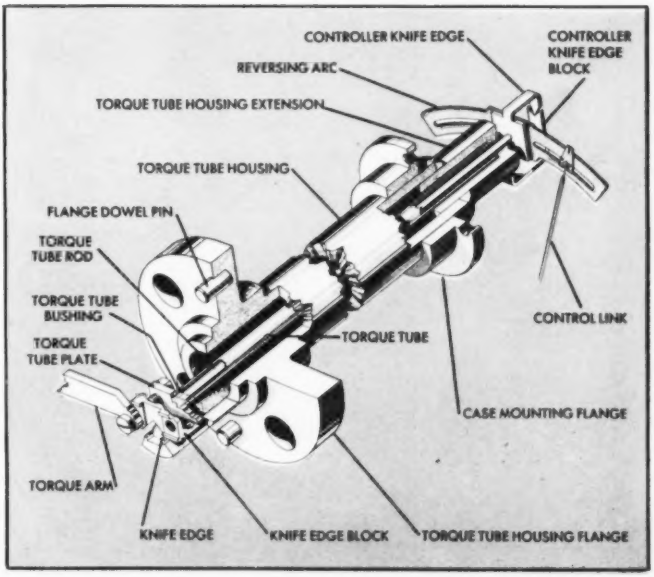


Fig. 20—Torque tube assembly and housing for a variable displacement type liquid level indicator

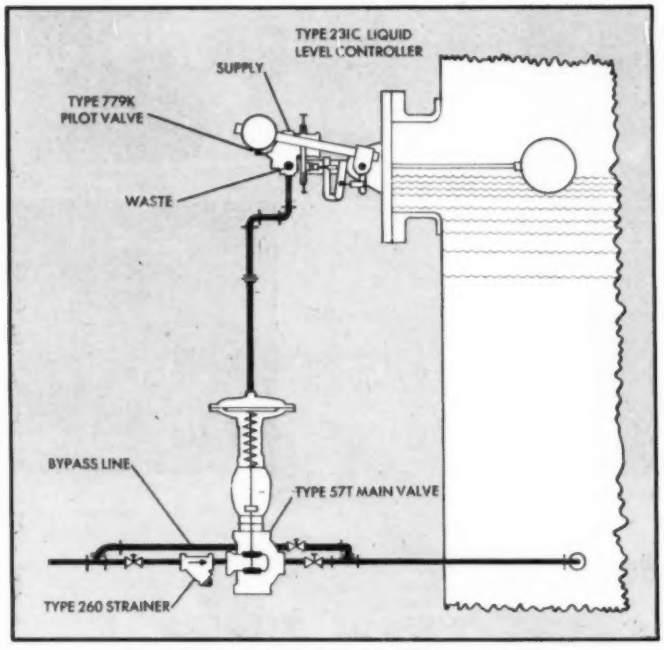


Fig. 21—Flange type ball float liquid level controller

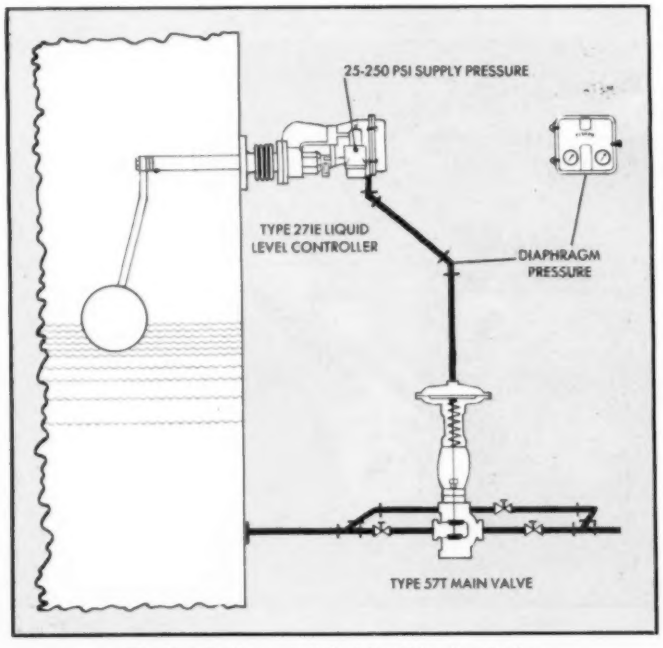


Fig. 22—Shaft type ball float liquid level controller

will be considerably less for a 100-lb. spring as compared to that for, say, a 10-lb. spring. The travel for one spring will not be exactly proportional to a different spring scale range, because for any given level, the displacement will depend upon scale range. With the 10-lb. spring, the displacer will rise further out of the water for a given level than it will with the 100-lb. spring; and in so doing will displace less water. Therefore, the displacement force for the same level in both cases will be greater with the 100-lb. spring scale and will destroy the linear relationship of variable spring scale range to float travel. In practice, however, the error is negligible and may be disregarded.

In a variable displacement type instrument, the spring and scale are replaced by a torque tube and torque rod (see Fig. 19). As the displacer falls, due to decrease in level, the torque tube twists to give a desired spring rate for a certain torque arm length. The angle of deflection of a torque tube is inversely proportional to the difference of the fourth powers of the tubing ouside and inside diameters. The complete assembly of torque tube and housing is shown in Fig. 20. In effect, as the torque arm raises or lowers with the displacer, the torque tube, which is attached to the torque arm by means of a torque tube plate, is twisted since it is anchored at the farther end to the torque tube housing extension. The angle of deflection of the torque tube is measured by the torque tube rod, also attached to the torque tube plate and which could be fastened to an indicator or pen to read level values on a calibrated scale. In the illustration, it will be noted that the torque tube assembly is mounted on knife edge bearings to eliminate friction. Another advantage of the torque tube is that it offers a packless bearing.

Ball Float Type

For certain applications, such as liquid level measurement of reduced crude in tower bottoms, the ball float type is used. If a variable displacer were used in such service, it would be necessary to flush the equalizing lines to prevent heavy bottoms from coking up the float chamber and consequently prevent correct level measurement. Flushing the leads, of course, introduces another operating medium, and one that usually provokes considerable attention in this service; therefore the preference for the ball float type instrument.

The dividing line, however, between the selection of the variable displacer and the ball float is not a hard and fast one. For services such as the above-mentioned on reduced crude, the basic consideration resolves itself into whether the attendant complexities of maintaining a reliable variable displacer is justified in lieu

of a comparatively simpler ball float. A number of different arrangements of ball floats are available, but the most common are the internal floats, flange and shaft types, as illustrated in Figs. 21 and 22. In both cases, as the float rises and falls with level changes, the motion of the float is translated through a stuffing box to an indicator or control mechanism. The shaft type offers greater rangeability, whereas the flange type is more readily adapted to installations where vessel diameters are small.

Ball floats are also available in external float chambers as well as being directly connected to a control valve for either internal or external floats. One is shown in Fig. 23. However, because of the disadvantages and attendant errors and lag introduced by the stuffing box, it is not usually as desirable as the variable displacer type.

Where the magnitude of level variations is great and must be measured, the use of a conventional flow meter used strictly as a differential pressure instrument is ideal. A typical installation is shown in Fig. 24. On the assumption that the specific gravity G_f in both connecting legs and the vessel is the same value, the pressures at O in both legs may be equated to one another as follows:

$$13.55h + H_1G_f = (H + H_1 + h)G_f$$

Transposing and solving for differential of the mercury manometer, h:

$$h = (HG_f)/(13.55 - G_f)$$

The seal pots and suitable sealing liquids as illustrated are used when it becomes necessary either to protect the meter from the tank liquid or to avoid measuring lag due to excessive viscosity of the tank liquid in the connecting lines. In services where entrained solids are encountered, liquid purges are used so that the solids do not accumulate in the meter chamber.

The assumption that the specific gravity G_f in both connecting legs and the vessel are equal is not in practice a very valid one. Generally speaking, the specific gravity in the connectings legs is different from that in the vessel due to the approach to ambient temperature in the legs, and or due to the use of sealing liquid with gravities also different from the vessel liquid. There are a number of ways of overcoming these inaccuracies, such as 1) the use of a chart or scale range greater or smaller than the distance between taps, and 2) the use of additional mercury to balance the difference in heads. Some manufacturers furnish adjustment mechanisms in the meter proper to accomplish this latter purpose. A more complete study of these methods can be obtained by reference to the accompanying brief bibliography.

While on the subject of specific gravity correction, it is worthwhile

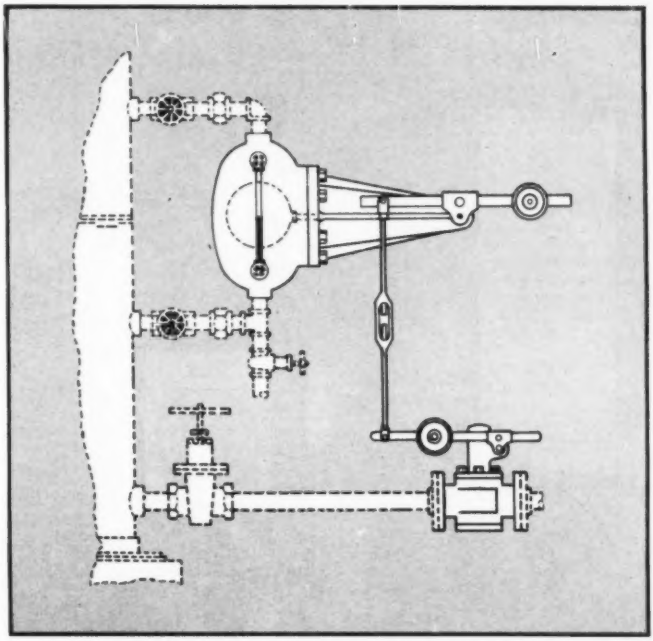


Fig. 23—External float chamber type of liquid level controller

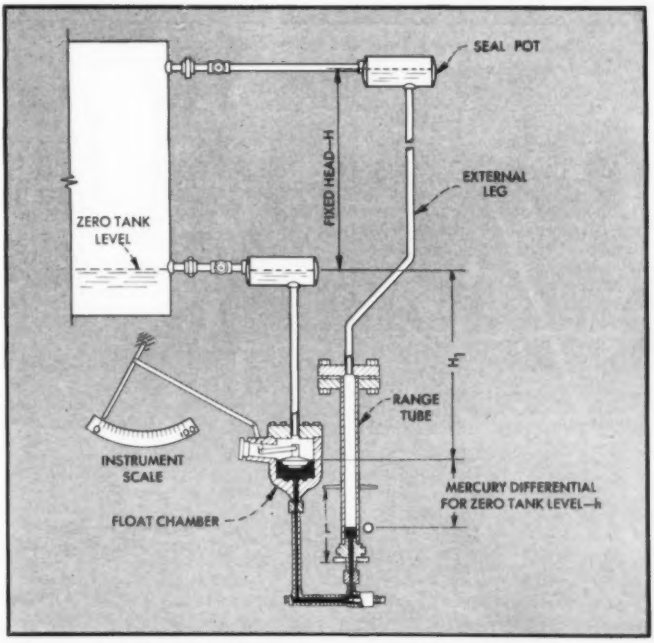
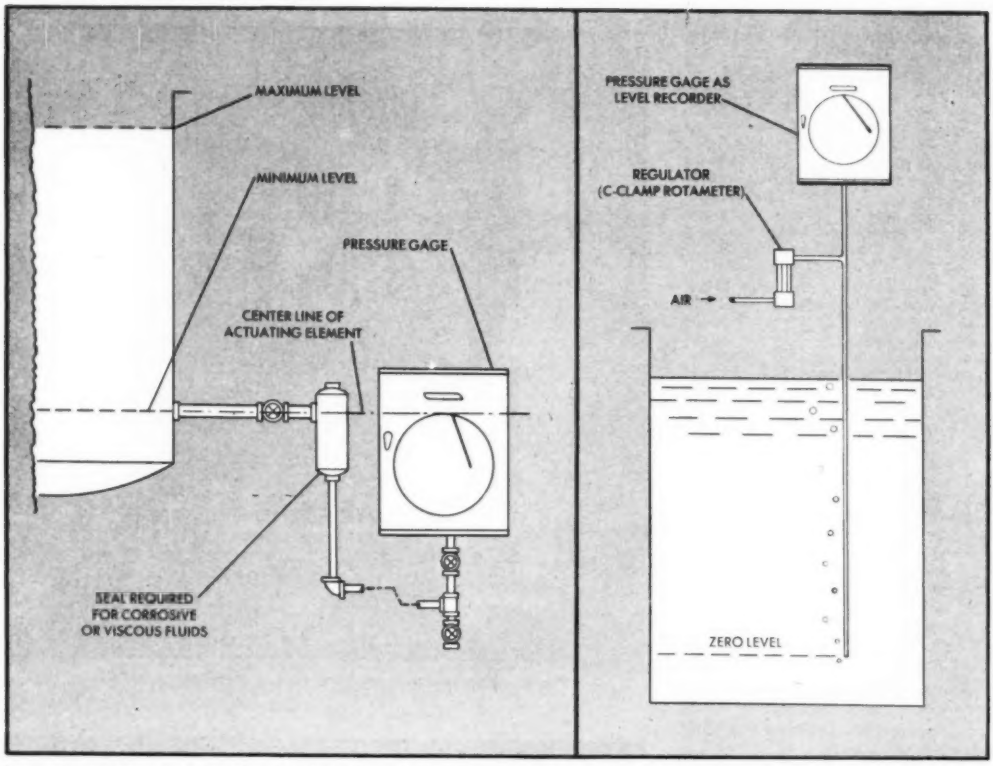


Fig. 24—Differential pressure type liquid level indicator



Figs. 25 and 26—(L to R) Two level instruments for open vessels; static head type and air purge, or bubbler, type

to note that this is a failing with almost all types of liquid level instruments. Take for example, the variable displacer type. It will be realized that for any give level, the displacement force will be in direct proportion to the specific gravity of the liquid in which it is immersed. Fortunately though, gravities can be predicted fairly accurately, and what deviations do occur are not of any great magnitude. Manufacturers provide easy and accessible means by which an operator can correct for gravity variations.

Interface Service

On applications such as oil-water settling drums, it is usually necessary to know the level which exists between the oil and the water being removed. This is referred to as interface service. Although any of the aforementioned devices have been used in this service, the most popular is the variable displacer. The same theory of operation applies to the displacer in interface service; the only difference being that previously the interface discussed was between liquid and gas whereas here it is between liquids of different specific gravities. In interface service the displacer is always completely immersed. Needless to say, the change in buoyancy for a unit change in interface level is much smaller in a liquid-liquid system than in a liquid-gas system. The preference for the displacer in this service is based on the fact that it is more sensitive to level changes.

Open Vessels

For the most part, the aforementioned equipment can be applied to open or closed vessels. There are a variety of other systems available for measuring level in open vessels, two of which are shown in Figs. 25 and 26. In Fig. 25, the pressure of the liquid head is imposed on the elastic element of the pressure gage and the range of the element is based upon the static head of liquid expected. It then is necessary only to calibrate the scale or chart to whatever units of measure are desired. This type of instrument is not applicable to a closed vessel because it would be affected by the vessel static pressure.

In Fig. 26, commonly referred to as the air purge system, the regulator which in effect is a restriction orifice, equalizes the pressure in the air line downstream of it to that of the liquid at zero level. As in the gage just discussed, it then becomes necessary only to select the proper gage and calibrate the scale or chart accordingly.

Radioisotopes

Recently, the use of radioisotopes has come into the picture as level measuring devices. Briefly, the usual arrangement is to place the radioactive material at strategic points on one side of the vessel and a Geiger counter on the other side. As the level rises or dips, more or less radiation reaches the counter and the strength of this signal can be calibrated in terms of level. The method is not restricted to liquids. It has already found use in petroleum processing operations in the measurement of solids in the case of catalyst level in cracking unit hoppers.

Picture Credits

Illustrations for this article were furnished through the courtesy of Mason-Neilan Regulator Co., Fisher Governor Co., and Minneapolis-Honeywell Regulator Co.

Bibliography

1. "Liquid Level Controllers," Catalog No. 402. Mason-Neilan Regulator Co.
2. "Technique of Measuring Liquid Level in Vessels under Pressure," by Cusick and Ross. *Instrumentation*, Vol. 3, No. 3. Minneapolis-Honeywell Regulator Co.

Refining Properties of New Crudes

Part 5—Characteristics of Crude Oils from the "Golden Trend" in Oklahoma

By N. A. C. SMITH, H. M. SMITH and C. M. McKINNEY*
Bureau of Mines Petroleum Experiment Station, Bartlesville, Okla.

Tabulated data are given on 36 analyses of crude oils from 19 fields along the "Golden Trend" in Garvin and McClain counties in Oklahoma. The analyses are compared with data on crude oils from older fields in the Mid-Continent. A summary is included of the general characteristics of products obtainable from the crudes from these new fields. Only one of the oils studied can be classified as high-sulfur.

SEVERAL of the most active oil-field development programs in Oklahoma during the past 5 years have resulted in the "Golden Trend" area in Western Garvin and McClain Counties becoming a major oil-producing area. During this period, more than 35 producing fields, having an estimated proved recoverable reserve of 130,299,000 bbls.[1] have been discovered and developed along the trend. During 1950, their average daily crude-oil production was approximately 51,000 bbls.[1]. During 1949, the last year for which drilling and development data are available, approximately 344 productive wells were drilled, and five new fields were discovered in the area.

Because of the increasing volume of proved reserves in fields along the trend and increased interest regarding the properties and characteristics of the crude oil produced, a sampling and analysis program was undertaken. Thirty-six samples of crude oils from 19 fields in Garvin and McClain Counties were obtained and analyzed during this study. Approximate locations of the fields from which samples were obtained are shown on Fig. 1. The most pertinent data obtained by the Bureau of Mines Routine Crude Oil Analysis Method[2] are given in table 1 for these 36 samples and for 3 additional crude oil samples from well-known Mid-Continent fields—Oklahoma City, West Edmond, and East Texas.

The oils studied were produced from formations ranging in age from the Hoxbar, Pennsylvanian, to the Joins formation, basal member of the Simpson formation, Ordovician. Producing depths ranged from a minimum of 808 ft. in the Northwest Hoover field to a maximum of 11,147 ft. in the North Lindsay field. Only one of the oils, that from the Northeast Roady field, has sufficiently high sulfur content (0.97 wt.%) to be classified as a high-sulfur crude oil. Twenty-two of the samples contained 0.15% or less sulfur, nine between 0.16 and 0.25% sulfur, and four between 0.26 and 0.50% sulfur.

The oils range in gravity from 69.5° API for the condensate-type crude oil produced from the Deese sand, Pennsylvanian, in the Southwest Maysville field, to 27.9° API for a sample from the same sand in the North Hoover field.

Complete analyses for samples from the Deese sand, Pennsylvanian; Hunton, Silurian-Devonian; and Simpson, Ordovician are given in Tables 2, 3, and 4. The fields represented by these samples are North Hoover (item 9), North Lindsay (item 17), and South Maysville (item 24), respectively in Table 1.

Comparison With Other Okla. Oils

Correlation-index (C.I.) curves[3] for crude oils from four fields along the trend are compared with C.I. curves for crude oils from the Oklahoma City, West Edmond, and East Texas fields in Fig. 2. Although the curves for the trend fields represent extremes in gravity-boiling point relationships for crude oils produced in the area, the differences are not great

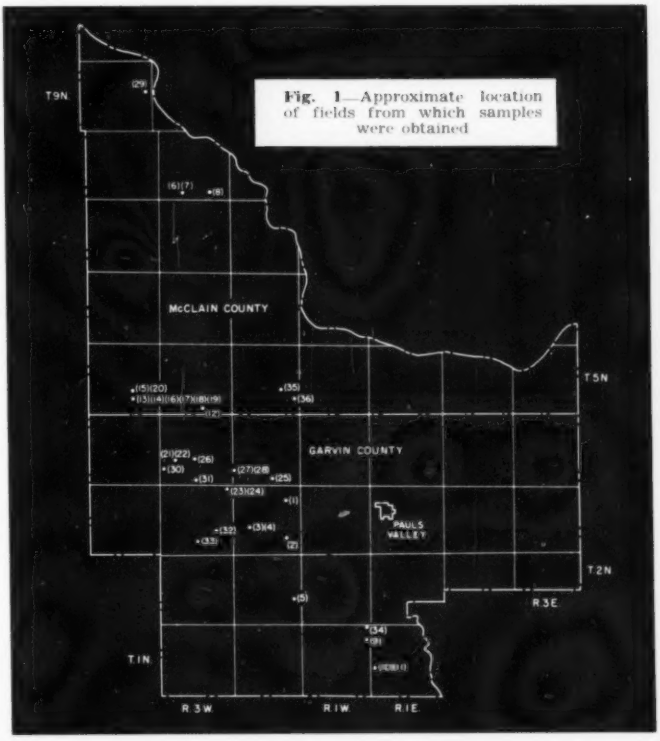


Fig. 1—Approximate location of fields from which samples were obtained

* Both N. A. C. Smith and H. M. Smith are Petroleum Chemists and C. M. McKinney is a Chemical Engineer.

Table 1—Summary of Pertinent Data for Oklahoma "Golden Trend" Crude Oils

Part 1—Summary of data showing sources and general characteristics of samples

Item	Sample	Field	County	Producing formation and age	Depth, ft.	Gravity °A.P.I.	Color[1]	Sulfur %	Viscosity 100° F. secs.	Carbon residue, %
	1	2	3	4	5	6	7	8	9	10
1	50143	Antioch, NE	Garvin	Hunton limestone, Sil.-Dev.	5,750- 5,770	46.3	Green	0.17	35	0.4
2	50125	Antioch, SE	Garvin	Second Deese sand, Pa.	5,473- 5,503	46.0	B.G.	21	35	1.0
3	50142	Antioch, SW	Garvin	Hart sand, Pa.	6,550- 6,580	40.9	B.G.	15	42	.6
4	50129	Antioch, SW	Garvin	First and second Gibson sands, Pa.	6,600- 6,640	42.1	NPA 8	11	39	7
5	50126	Elmore, NE	Garvin	Gibson sand, Pa.	6,409- 6,454	42.1	NPA 8	14	38	7
6	50131	Goldsby, SW	McClain	Bromide sand, Simpson, Ordovician	9,370- 9,380	39.2	B.G.	18	42	1.7
7	50140	Goldsby, SW	McClain	Bromide sand, Simpson, Ordovician	10,600	39.4	G.B.	21	41	1.3
8	50143	Goldsby, SW	McClain	Joins formation, Simpson, Ordovician	9,500- 9,550	38.8	B.G.	24	44	2.2
9	51025	Hoover, North	Garvin	First Deese, Pa.	4,500- 4,516	45.6	G.B.	47	33	1.0
10	50128	Hoover, NW	Garvin	Hoxbar sand, Pa.	808- 862	40.4	B.G.	40	41	1.7
11	50127	Hoover, NW	Garvin	Hoxbar sand, Pa.	1,493- 1,558	39.6	B.G.	42	42	1.8
12	50145	Lindsay, East	McClain	Simpson, Ordovician	9,600- 9,650	40.2	G.B.	21	40	1.2
13	50121	Lindsay, North	McClain	Bromide sand, Simpson, Ordovician	10,853-11,075	40.2	NPA 5	11	35	.4
14	50123	Lindsay, North	McClain	Bromide sand, Simpson, Ordovician	10,820-11,147	47.6	NPA 5	< 10	33	.3
15	50115	Lindsay, North	McClain	Bromide sand, Simpson, Ordovician	10,771-11,062	53.5	NPA 5½	< 10	32	.2
16	50118	Lindsay, North	McClain	Bromide sand, Simpson, Ordovician	10,897-11,136	43.8	NPA 7	15	36	.5
17	50120	Lindsay, North	McClain	Hunton limestone, Sil.-Dev.	9,929-11,075	44.7	NPA 5	10	35	.3
18	50122	Lindsay, North	McClain	Hunton limestone, Sil.-Dev.	9,995-11,147	63.6	NPA 1½	< 10	32	< .1
19	50116	Lindsay, North	McClain	Hunton limestone, Sil.-Dev.	9,628-11,136	44.3	NPA 6	11	35	.4
20	50114	Lindsay, North	McClain	Hunton limestone, Sil.-Dev.	9,857-11,062	52.3	NPA 4	< 10	32	.2
21	50132	Lindsay, SE	McClain	Bromide sand, Simpson, Ordovician	9,600- 9,660	44.5	NPA 6	12	36	.4
22	50144	Lindsay, SE	McClain	Chimney Hill, Hunton, Sil.-Dev.	9,500- 9,600	43.4	NPA 7	< 10	38	.6
23	50138	Maysville, South	Garvin	Gibson sand, Pa.	6,220- 6,240	43.6	Green	13	38	.5
24	50136	Maysville, South	Garvin	Bromide sand, Simpson, Ordovician	6,220- 6,250	45.2	B.G.	20	37	1.1
25	50135	Maysville, SE	Garvin	Bromide sand, Simpson, Ordovician	6,249- 6,258	38.8	B.G.	34	41	1.8
26	50139	Maysville, SW	Garvin	Gibson sand, Pa.	7,350- 7,370	41.3	Green	15	39	.7
27	50133	Maysville, SW	Garvin	Third Deese sand, Pa.	6,564- 6,830	60.5	NPA 1½	< 10	< 32	< .1
28	50124	Maysville, SW	Garvin	Upper Bromide sand, Simpson, Ord.	7,410- 7,425	55.9	Green	< 10	32	.4
29	51019	New Castle, East	McClain	Hunton limestone, Sil.-Dev.	8,890- 8,900	41.9	Green	11	43	.8
30	50111	New Hope, SE	Garvin	Gibson sand, Pa.	7,318- 7,380	41.1	Green	19	41	.9
31	50112	New Hope, SE	Garvin	Gibson sand, Pa.	6,960- 6,972	43.4	Green	14	37	.7
32	50141	Panther Creek	Garvin	Fourth Deese sand, Pa.	7,100- 7,110	42.3	Green	18	36	.7
33	50110	Panther Creek, SW	Garvin	Hart sand, Pa.	8,075- 8,127	41.9	Green	21	38	1.1
34	51024	Ready, NE	Garvin	Deese sand, Pa.	4,528- 4,583	27.9	B.B.	97	128	.7
35	50130	Wayne, SW	McClain	Pennsylvanian sand, Pa.	6,660- 6,660	44.3	NPA 8	12	38	.8
36	50131R	Wayne, SW	McClain	Pennsylvanian sand, Pa.	6,680- 6,720	56.2	NPA 7	< 10	46	.3
37	40156	Oklahoma City	Oklahoma	Wilcox, Ordovician	[2]	38.2	B.G.	13	47	1.1
38	45031	Edmond, West	Canadian	Hunton, Devonian	[2]	41.5	B.G.	14	39	.6
39	45035	East Texas	Rusk, Tex.	Woodbine, Upper Cretaceous	[2]	37.8	B.B.	36	44	2.3

Part 2—Summary of analytical and computed data

Item	Volume percentages Fractions 1-3, inc. (light gasoline)	4-7, inc. (naphtha)	8-12, inc. (kerosine and gas oil[3])	13-15, inc. (lubricating oil[3])	Residuum	Correlation Index averages of fractions 4-7, inc.	13-15, inc.	Characteristics of Residuum % on gasoline, free basis	Sp. Gr.
	11	12	13	14	15	16	17	18	19
1	15.3	30.0	26.4	13.0	14.8	18	31	27	0.918
2	17.1	28.1	24.1	11.0	17.2	19	33	33	.939
3	9.4	24.2	26.7	16.2	21.9	20	33	34	.917
4	11.0	23.6	26.2	14.3	22.3	19	34	36	.914
5	11.1	25.9	26.4	15.7	20.2	19	33	32	.918
6	10.6	22.1	26.2	16.2	24.0	22	35	36	.929
7	11.4	21.0	26.2	16.5	23.4	24	35	35	.938
8	11.9	20.6	25.3	15.0	23.9	22	39	37	.951
9	18.7	35.3	21.5	10.1	13.3	21	45	30	.866
10	15.7	20.7	23.7	14.0	24.5	21	38	39	.943
11	12.3	20.3	24.1	15.1	25.6	21	37	40	.939
12	11.9	23.4	26.4	15.2	22.7	22	35	35	.932
13	15.5	27.7	26.7	14.3	14.6	23	32	26	.914
14	17.9	28.4	25.0	12.8	12.9	22	31	25	.912
15	27.7	33.6	19.3	9.6	8.2	21	29	22	.904
16	13.5	28.7	26.4	14.8	15.9	22	33	28	.921
17	14.9	34.1	26.1	14.3	14.5	21	31	26	.913
18	22.3	68.6	4.2	..	3.6[4]	19	..	46	.842
19	11.5	33.2	24.4	13.8	15.5	21	32	28	.913
20	7.5	64.5	17.3	2.1	7.1[4]	19	..	27	.900
21	10.6	28.3	26.7	13.7	16.4	23	30	29	.905
22	11.5	23.5	27.2	15.4	19.7	19	32	32	.915
23	12.9	23.2	24.3	13.8	21.4	20	32	36	.911
24	18.5	24.8	23.9	13.3	17.5	22	35	32	.934
25	10.9	23.4	24.9	16.1	22.7	23	37	36	.949
26	11.0	23.0	27.0	15.6	21.9	20	33	34	.918
27	47.6	37.0	4.2	..	3.5[4]	19	..	45	.839
28	32.8	32.6	15.6	6.8	8.8	20	33	28	.919
29	11.9	25.4	24.8	13.6	22.4	18	33	37	.923
30	10.6	22.1	27.6	18.6	19.0	21	35	29	.927
31	13.3	26.2	26.0	13.9	19.6	19	34	33	.920
32	14.1	27.9	25.6	13.1	18.6	21	35	32	.937
33	14.3	23.3	23.0	15.2	21.2	23	37	36	.931
34	6.6	16.1	20.4	11.7	44.7	21	44	58	.980
35	14.2	24.5	24.5	13.3	21.2	18	33	36	.914
36	22.2	55.1	7.3	..	15.2[4]	18	..	64	.888
37	8.2	19.1	24.4	16.8	29.8	19	35	42	.924
38	11.5	22.1	26.2	17.0	21.3	22	34	33	.916
39	12.5	21.8	25.5	16.0	22.8	27	40	35	.966

[1] Colors of crude oils in this table are designated as follows: brownish-black, B.B.; brownish green, B.G.; greenish black, G.B.; green, no abbreviation and NPA numbers.
[2] Approximate.
[3] Not comparable because of variation of final distillation temperature.

in comparison with frequently observed differences between oils in a specific geologic area. Previous reports in this series [1-5] have included C.I. curves for extreme types of paraffin, intermediate, and aromatic crude oils. Comparison shows that no oils of these extreme types were encountered in the present study.

Of seven oils produced from the Hunton limestone, two are condensate-type crude oils from the North Lindsay field definitely different from each other and from the other oils. Four of the oils—two from North Lindsay, one from Southeast Lindsay, and one from Northeast Antioch—are similar. The distillate portion of the East New Castle oil is similar to the other Hunton oils, but the residuum is definitely different.

Two of the 17 oils produced from Pennsylvanian formations—Southwest Maysville and Southwest Wayne fields—are condensate-type oils and definitely different from the other oils; 7 oils are similar, representing production from the Southwest Antioch (2 samples), Northeast Elmore, South Maysville, Southwest Maysville, Southeast New Hope, and Southwest Wayne fields. Two of the oils, those from North Hoover, and Northeast Roady, are definitely different because of high sulfur contents, correlation indexes and residuum specific gravities. The two oils from the Northwest Hoover field are similar, two oils from the Panther Creek and Southwest Panther Creek field are similar, and two oils from Southeast Antioch and Southeast New Hope are similar. Other similarities than those discussed may be observed in Table 1.

Twelve samples from the Simpson formation are represented in Table 1. Maximum variations between properties of all of these oils are not great but are large enough to prevent more than three of the oils being described as definitely similar. However, similarities exist between all of the oils, especially in the character of the light distillate fractions. The carbon residue of the Simpson oils produced in the North Lindsay, Southeast Lindsay, and Southwest Maysville fields is noticeably lower than the Simpson oils from other fields along the trend.

Utilization

The same general system used in previous articles of this series has been followed in discussing utilization. Information regarding several important commercial products is given, based on the limited data determined by the routine analysis.

Aviation base stock: A low naphthene and aromatic content and correspondingly low octane numbers of distillate in the light gasoline boiling range are indicated by the low C.I. values for fraction 4 of all of the crude oils tested. It is unlikely that any of the crude oils would be a commercially suitable source of aviation base stock.

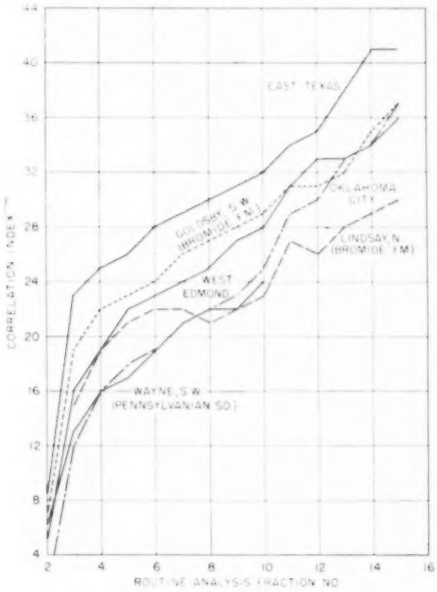


Fig. 2—Comparison of crude oils from the "Golden Trend" area and several other Mid-Continent crude oils

Motor gasoline: Yields of 400° F. end-point gasoline obtained by straight-run distillation ranging from 25 to 90 vol. % and averaging approximately 35 to 40% are indicated. The octane numbers would be rather low but could be increased to within specifications for regular-grade gasoline by the addition of tetraethyllead. Blending with cracked stock or other reformed products of higher oc-

Table 2—Routine Analysis of Crude Oil from First Deese, Pennsylvanian, North Hoover Field, Garvin County, Okla.

Identification		General Characteristics	
Sample 51025	Sp. Gr.		0.799
Hoover, North field	API Gr.		45.6°
First Deese, Pennsylvanian	Sulfur, %		0.47
4500-4516 ft.	Pour Point, °F.		<5
Garvin County, Okla.	Color		greenish brown
	Viscosity, S.U.S. @ 100° F., sec.		33

Distillation, Bureau of Mines Routine Method

Stage 1—Distillation at atmospheric pressure, 751 mm. Hg
First drop, 28° C. (82° F.)

Fraction No.	Cut at °C.	Cut at °F.	Cut at %	Sum. %	Sp. Gr., 60°/60° F.	°API, 60° F.	C.I.	Aniline point, °C.	S.U. Visc., 100° F.	Cloud test, °F.
1	50	122	3.7	3.7	0.637	90.6				
2	75	167	5.4	9.1	.667	80.6	6.1			
3	100	212	9.6	18.7	.707	68.6	15	58.2		
4	125	257	12.3	31.0	.732	61.8	18	57.5		
5	150	302	8.9	39.9	.752	56.7	20	58.6		
6	175	347	8.0	47.9	.770	52.3	22	59.8		
7	200	392	6.1	54.0	.785	48.8	23	62.2		
8	225	437	5.5	59.5	.801	45.2	24	65.8		
9	250	482	5.1	64.6	.816	41.9	26	68.4		
10	275	527	5.2	69.8	.833	38.4	30	69.8		
Stage 2—Distillation continues at 40 mm. Hg										
11	200	392	1.7	71.5	0.848	35.4	33		45	Below 5
12	225	437	4.0	75.5	.861	32.8	35	73.2	46	26
13	250	482	3.3	78.8	.882	28.9	42		60	35
14	275	527	2.6	81.4	.894	26.8	44		91	55
15	300	572	4.2	85.6	.913	23.5	50		190	70
Residuum			13.3	98.9	.966	15.0				

Carbon residue of residuum, 6.5 percent; carbon residue of crude, 1.0 percent

Approximate Summary

Light Gasoline	%	Sp. Gr.	°API	Viscosity
	18.7	**0.681**	**76.3**	
Total gasoline and naphtha	54.0	0.726	62.6	
Kerosine distillate	10.6	.822	40.6	
Gas oil	10.0	.841	36.2	
Nonviscous lubricating distillate	5.8	.867–.886	31.7–28.4	50–100
Medium lubricating distillate	3.5	.886–.915	28.4–23.1	100–200
Viscous lubricating distillate	1.7	.915–.925	23.1–21.5	Above 200
Residuum	13.3	.966	15.0	
Distillation loss	1.1			

Table 3—Routine Analysis of Crude Oil from Hunton Limestone, North Lindsay Field, McClain County, Okla.

Identification
Sample 50120
Lindsay, North field
Hunton Limestone, Sil.-Dev.
9929-11,075 ft.
McClain County, Okla.

General Characteristics

Sp. Gr.	0.803
API Gr.	44.7°
Sulfur, %	0.10
Pour Point, °F.	<5
Color	NPA No. 5
Viscosity, S.U.S. @ 100° F., sec.	35

Distillation, Bureau of Mines Routine Method

Stage 1—Distillation at atmospheric pressure, 745 mm. Hg
First drop, 25° C. (77° F.)

Fraction No.	Cut at °C.	Cut at °F.	%	Sum. %	Sp. Gr., 60/60° F.	°API, 60° F.	C.I.	Aniline point, °C.	S.U. Visc., 100° F.	Cloud test, °F.
1	50	122	1.9	1.9						
2	75	167	2.8	4.7	0.655	84.5				
3	100	212	6.2	10.9	.707	68.6	15	57.4		
4	125	257	9.6	20.5	.732	61.8	18	55.8		
5	150	302	9.7	30.2	.751	56.9	19	56.2		
6	175	347	7.8	38.1	.770	52.3	22	58.0		
7	200	392	6.9	45.0	.785	48.8	23	61.2		
8	225	437	5.8	50.8	.800	45.4	24	66.1		
9	250	482	5.7	56.5	.813	42.6	25	69.6		
10	275	527	6.0	62.5	.826	39.8	26	74.6		
Stage 2—Distillation continued at 40 m. Hg										
11	200	392	3.3	65.8	0.838	37.4	28		39	20
12	225	437	5.3	71.1	.846	35.8	28	83.4	44	35
13	250	482	5.1	76.2	.857	33.6	30		53	55
14	275	527	4.1	80.3	.866	31.9	31		73	75
15	300	572	5.1	85.4	.874	30.4	32		120	90
Residuum			14.5	99.9	.913	23.5				

Carbon residue of residuum, 2.1 percent; carbon residue of crude, 0.3 per cent.

Approximate Summary

	%	Sp. Gr.	°API	Viscosity
Light gasoline	**10.9**	**0.695**	**75.1**	
Total gasoline and naphtha	45.0	0.739	60.0	
Kerosine distillate	11.5	.806	44.1	
Gas oil	15.5	.837	37.6	
Nonviscous lubricating distillate	8.9	.853–.871	34.4–31.0	50–100
Medium lubricating distillate	4.5	.871–.878	31.0–29.7	100–200
Viscous lubricating distillate				Above 200
Residuum	14.5	.913	23.5	
Distillation loss	1			

tane number would be necessary to obtain satisfactory premium-grade motor gasoline. The sulfur content is sufficiently low so that a minimum of treatment for sulfur reduction is necessary.

Kerosine: The low specific gravity (indicating a low-percentage of cyclic compounds) of distillate in the kerosine boiling range and the low sulfur content indicate that kerosine of good quality and excellent burning characteristics could be obtained from most of these oils. Maximum yields of 15 to 17 vol. % are indicated for several of the samples analyzed.

Table 4—Routine Analysis of Crude Oil from Bromide Sand, Simpson, Ordovician, South Maysville, Garvin County, Okla.

Indentification
Sample 50136
Maysville, South field
Bromide sand, Simpson, Ordovician
6220-6250 ft.
Garvin County, Okla.

General Characteristics

Sp. Gr.	0.801
API Gr.	45.2°
Sulfur, %	0.20
Pour Point, °F.	<5
Color	brownish green
Viscosity, S.U.S. @ 100° F., sec.	37

Distillation, Bureau of Mines Routine Method

Stage 1—Distillation at atmospheric pressure, 743 mm. Hg
First drop, 36° C. (97° F.)

Fraction No.	Cut at °C.	Cut at °F.	%	Sum. %	Sp. Gr., 60/60° F.	°API, 60° F.	C.I.	Aniline point, °C.	S.U. Visc., 100° F.	Cloud test, °F.
1	50	122	6.1	6.1	0.658	99.3				
2	75	167	5.4	11.5	.667	80.6	6.1	59.2		
3	100	212	7.0	18.5	.706	68.1	16	56.6		
4	125	257	7.9	26.4	.735	61.0	19	54.5		
5	150	302	6.3	32.7	.755	55.9	21	55.2		
6	175	347	5.9	38.6	.772	51.8	23	57.5		
7	200	392	4.7	43.3	.785	48.8	23	65.0		
8	225	437	5.1	48.4	.798	45.8	24	65.4		
9	250	482	5.0	53.4	.811	43.0	24	68.2		
10	275	527	5.4	58.8	.825	40.0	26	72.8		
Stage 2—Distillation continued at 40 mm. Hg										
11	200	392	3.7	62.5	0.840	37.0	29	75.6	40	10
12	225	437	4.7	67.2	.850	35.0	30	79.6	45	30
13	250	482	4.5	71.7	.864	32.3	33		56	45
14	275	527	4.2	75.9	.877	29.9	36		79	70
15	300	572	4.6	80.5	.885	28.4	37		135	90
Residuum			17.5	98.0	.934	20.0				

Carbon residue of residuum, 5.3 per cent; carbon residue of crude, 1.1 per cent.

Approximate Summary

	%	Sp. Gr.	°API	Viscosity
Light gasoline	**18.5**	**0.673**	**78.8**	
Total gasoline and naphtha	43.3	0.722	64.5	
Kerosine distillate	15.5	.812	42.8	
Gas oil	8.4	.847	35.6	
Nonviscous lubricating distillate	8.4	.836–.857	37.8–33.6	50–100
Medium lubricating distillate	8.3	.857–.882	33.6–28.9	100–200
Viscous lubricating distillate	5.0	.882–.889	28.9–27.7	Above 200
Residuum	17.5	.934	20.0	
Distillation loss	2.0			

Diesel Fuel: Excellent Diesel-fuel distillate may be obtained from most of the crude oils analyzed. Straight-run distillates in the 350°-675° F. ASTM distillation boiling range would be expected to have cetane numbers in the range 45 to 55. However, as wax is obtained in the higher-boiling portion of this distillate from all of the crude oils analyzed, the upper boiling range of straight-run distillate for Diesel-fuel utilization is limited by cloud and pour-point specifications.

Fuel Oils: Limitations upon the types and percentage yields of fuel oils that are obtained from these oils are dependent on demand rather than limitations imposed by characteristics of the crude oil, and yields are varied by varying the refining process. Satisfactory fuels of both major types, distillate and residual, may be obtained with a minimum of processing.

Lubricating Oils: Satisfactory lubricating oils in the low viscosity range may be made from all of the oils analyzed except those of the condenate type having no distillate in the lubricating distillate range and possibly the high-sulfur oil from Northeast Roady and the oil from North Hoover. The yields should be comparable in quality but of probably slightly less quantity than from Oklahoma City and West Edmond crude oils.

Asphalt: The yield of 100-penetrations asphalt would be low for most of the crude oil analyzed. Highest indicated yield would be approximately 10% from the crude oil produced from the Joins formation in the Southwest Goldsby field. Nine of the oils apparently contain between 5 and 10%, and the remaining oils contain less than 5% 100-penetration asphalt. The yield figures given above are based on the relationship given in an earlier article,[4] which indicates that percentage carbon residue in the crude oil is approximately equal to the yield of 100-penetration asphalt.

References

(1) Anon., "Production and Proved Remaining Reserves—By Fields" *Oil and Gas Journal*, Vol. 49, No. 38, pp. 254-259, Jan. 25, 1951.

(2) Smith, N. A. C., Smith, H. M., Blade, O. C., and Garton, E. L., "The Bureau of Mines Routine Method for the Analysis of Crude Petroleum." Part 1. The Analytical Method. *Bur. of Mines Bulletin*, in press.

(3) Smith, H. M., "Correlation Index to Aid in Interpreting Crude Oil Analyses," *Bur. of Mines Tech. Paper 610*, (1940).

(4) Smith, N. A. C., Smith, H. M., and McKinney, C. M., "Refining Properties of New Crudes." Part 1—Significance and Interpretation of Bur. of Mines Routine Crude Oil Analysis. PETROLEUM PROCESSING, Vol. 5, No. 6, pp. 609-614, June 1950. Part 2—Characteristics of Crude Oils from the Scurry County, Texas, Area. PETROLEUM PROCESSING, Vol. 5, No. 7, pp. 731-734, July 1950. Part 3—Crude Oils from Recent Discoveries in Kansas. PETROLEUM PROCESSING, Vol. 5, No. 9, pp. 960-964, Sept., 1950.

(5) Hall, J. S., Wenger, W. J. and Whisman, M. L., "Refining Properties of New Crudes." Part 3—Crude Oils from Recent Discoveries in the Rocky Mountain Region. PETROLEUM PROCESSING, Vol. 5, No. 8, pp. 842-846, August, 1950.

How petroleum serves the American people every day of the year is portrayed dramatically in a colorful, new exhibit produced by the Oil Industry Information Committee, and now ready for distribution. Equipped with a flasher-light to attract attention, the display emphasizes the manifold uses of petroleum in industry, transportation, agriculture, in the home and in national defense. It is especially suitable for windows, bank and building lobbies, and schools.

It is expected to be particularly useful next month during Oil Progress Week, October 14-20. However, the exhibit was designed for year-around service.

The message to the public from the oil industry, in the main central panel, is: "In peace or war, America's thousands of privately-managed oil companies, competing vigorously, provide you with the finest oil products in the world at the world's lowest prices."

Two side panels illustrate the many uses of oil in the nation's social, economic, and business life. Each exhibit is folded and packed in a corrugated box and can be set up in a few minutes. It is being made available at cost ($7.50 each, plus shipping charges) to oil companies and trade associations. (Sorry, the beautiful young lady is not included.)

No more air-polluting smoke from the Standard Oil Co. (Ohio) refinery at Cleveland as a result of this automatic boiler combustion control system. The unit shuts off normal fuel oil supply to burners and cuts in to waste gas whenever it's available. Result: no smoke at boiler stacks or from plant flare stacks. More than 80% of gases normally burned at the flares is utilized as boiler fuel with the system. Controls cost $25,000, a portion of $271,000 Sohio spent last year on air pollution prevention.

Molecules per day could be the measure of capacity on this distillation unit in use at the Beacon Research Laboratories of The Texas Co. It permits molecular distillation of tiny micro samples. For instance, Texaco recently had to analyze a lube sample that wasn't even big enough to make a respectable spot on your shirt front. Weighing 0.7 gm., the sample was "run to still." One third, collected as condensate, and the residual "bottoms", then received further analysis and studies.

Top of regenerator for Fluid catalytic cracking unit at new Fawley refinery is lifted into position

FAWLEY

New Era in Refining in Europe

By V. B. GUTHRIE
Editor

SYMBOL of today's developments in the petroleum industry in Europe is the large new refinery of Esso Petroleum Co. Ltd. (Standard of New Jersey affiliate) in Fawley, on the south coast of Great Britain, near Southampton. The plant was to be officially opened Sept. 14 by Prime Minister Atlee with appropriate ceremonies, the crude distillation units now being in operation.

Started in July, 1949, it is scheduled to be finished by the end of 1953 as a complete refinery, with a crude charging capacity of nearly 130,000 b.d. The Fawley refinery will be the largest of those being built, or at present contemplated, to make Great Britain an important world petroleum refining center. Its potential output of 6,000,000 tons of products annually will be almost a third of the 20,000,000 tons proposed for the new refinery expansion program in Britain. Its capital investment of approximately $105,000,000 represents a substantial portion of the total investment of $350,000,000 for new refineries. It will employ 2500 workers when fully operating.

The building of a refining industry at home reverses the policy of oil companies in England prior to World War II, who were then mainly engaged in marketing products refined at the source of crude oil production. Economic conditions dictated the change. World consumption of petroleum has been rising at a rate that made refining capacity in general inadequate to handle the growing requirements for many types of refined products. In the period since the war crude from the Middle East has taken the place of that from the Western Hemisphere as most economically available to oil companies in Europe. Furthermore, refining in Britain, as compared with refining in other areas and importing finished products, meant a saving in the hard currencies which have been drastically short in Europe, especially in Great Britain.

The two large crude distillation units at Fawley were started up on July 16 and Aug. 21 respectively. They will process oil from the Middle Eastern fields of Kuwait and Iraq and to a lesser extent Persia.

The Fluid catalytic cracking unit, with a charging capacity of 41,000 b.d. and the Edeleanu sulfur dioxide solvent extraction plant of 13,000 b.d. charge capacity are scheduled to go on stream Oct. 1. Still to be completion in 1953. Foster Wheeler tion plant, and the solvent lubricating oil units which are scheduled for completion in 1953. Foster Wheeler Corp. is the prime contractor for the entire refinery project.

The new plant adjoins the original refinery of the same company built in 1920, with a capacity of around 20,000 b.d. Its equipment included two small crude distillation units, a series of crude shell stills, two modified Cross tube-and-tank units and a sweetening plant. This plant made gasoline, gas oil, diesel fuel, heavy fuel oil and asphalt. Two thermal reforming units have been built by revamping equipment in the old refinery. These will be used in connection with the new refinery for improving the octane rating of the straight-run gasoline from the two crude distillation units.

The various modern process units installed in the new Fawley refinery are of conventional design, but with

Aerial view of the new Esso Refinery at Fawley, England. Note size of large white structure—the maintenance building

many minor engineering improvements in their construction. Some of the units were designed by Standard Oil Development Co. The processes installed are described briefly below:

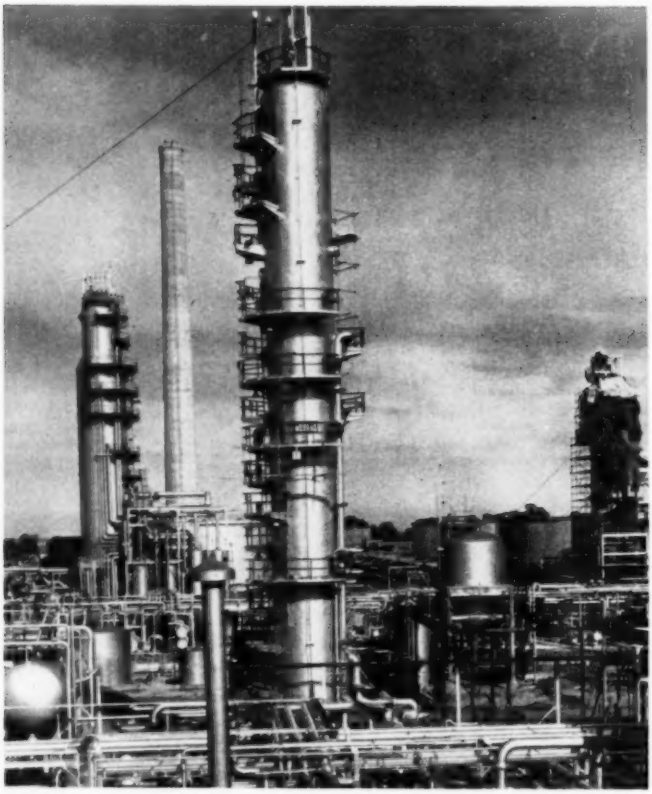
Single-stage atmospheric crude distillation unit: This unit has a charge capacity of 66,000 b.d. It was designed to reparate the crude into naphtha and kerosine fractions, but is to be used currently to produce mainly gas oil cracking stock and fuel oil. The unit is designed to distill down to about 25% bottoms, the bottoms to be cut back to heavy fuel oil by addition of "cat cracker" products.

Pipe still furnace for this unit is a two-flow system, with two convection banks and two radiant heating banks with a central flue. Heat releasing capacity is 250,000,000 Btu hr. Two flash drums before the pipe still separate water and lighter gases.

The fractionating tower for this unit is 124 ft. high by 21 ft. in diameter, with 35 trays. The column is protected against corrosion by an internal clad lining, partly Monel metal, partly stainless steel. A pump around system provides reflux to the trays. Light gasoline is taken off overhead and heavier cuts as sidestreams.

Two-stage atmospheric and vacuum crude distillation unit: Has a charge capacity of 60,000 b.d. and is designed to distill down to a 20% residuum. The gas oil and waxy frac-

A novel design feature of the 41,000 b.d Fluid unit at Fawley is the provision for returning spent catalyst to the regenerator through an annular space between the inner and outer shells of the reactor



Debutanizer tower, with the crude units in the background, and the Fluid unit at left

tions at present will be used as charge stock for the "cat cracker" but the major purpose of this unit will be to produce lubricating oil distillates and asphalt when the lube oil units are completed.

The pipe still for this unit is a double-furnace unit, the first section feeding the atmospheric column being similar in type to the pipe still for the single-stage crude distillation unit, and having a heat release capacity of 156,000,000 Btu/hr. The second section has one convection bank and one radiant heat bank, with a heat release capacity of 85,000,000 Btu/hr. This unit also has two flash drums prior to the still.

Operation of the two crude distillation units is from a common control room.

Copper chloride sweetening units: Two units of the same type have been installed, refining experience having proved the desirability of having separate sweetening-finishing facilities for the natural distillate fractions of the crude and for the distillates from the catalytic cracking plant.

Edeleanu sulfur dioxide extraction unit: The 13,000 b/d plant was designed by E. B. Badger & Sons Co. The raw kerosine is treated to reduce the sulfur content and remove other undesirable components. Straight-run gas oil will also be treated, the extract being used for fuel blending.

Tractor fuel plant: In this unit a heavy naphtha is desulfurized in the vapor state, in the presence of a special catalyst. Hydrogen is used to promote the desulfurization reaction and a hydrogen generator is an integral auxiliary process unit.

Fluid catalytic cracking: 41,000 b/d of heavy gas oil will be converted into high-octane motor gasoline components, and substantial volumes of gaseous products will be recovered for domestic and industrial use. Feed stock will be mostly the heavy waxy gas oils from the crude distillation units.

The size of this unit is indicated by the dimensions of reactor and regenerator. The reactor is 35 ft. in diameter by 70 ft. high and of the new design in which the spent catalyst passes through an annular space between the inner and outer shells to the regenerator. The regenerator is 55 ft. in diameter and 70 ft. high. The largest catalyst transfer line is 108 in. in diameter. Flue gases leaving the regenerator pass through 12 three-stage cyclones, thence to waste heat boilers where steam is generated at 125 psi. and transferred to the process steam lines.

The fractionating column for the Fluid unit is 130 ft. high and 20 ft. in diameter, fitted with 20 bubble trays. Fractions separated are wet gas, light and heavy cracked gasoline and heavier side streams, which can either be recycled for further cracking or used as blending stock for Bunker C fuel oil. The wet gas and light gasoline go to the de-butanizer column, which is 88 ft. high, 10 ft. in diameter and fitted with 31 trays, designed for 250 psi. working pressure. When the polymerization plant is completed, a C_4 sidecut from the de-butanizer will be demethanized and used for feed for production of polymer gasoline.

Light ends unit: Its major function will be to separate the light gases and raw gasoline distillate from the fluid catalytic cracking unit into specification intermediate products for subsequent processing and blending.

Polymerization plant: This plant will be of the largest of this type in the world, for the conversion of butylene into high-octane liquid gasoline in the presence of a solid phosphoric acid catalyst.

Propane deasphalting: Here liquid propane will extract asphaltic substances from raw high-viscosity lubricating oil distillates from the crude distillation units to provide a superior quality stock for subsequent processing.

Phenol solvent refining plant: This selective extraction process will separate raw lubricating oil distillates into desirable and undesirable fractions and provide for production of high quality lubricating oils and waxes from the desirable fractions.

Propane dewaxing unit: Liquid propane in mixture with the refined raffinate from the phenol refining unit precipitates the wax and thereby produces a lubricating oil which will be fluid at low temperatures. The wax is filtered from the oil and finished for the production of crystalline paraffin wax and also the amorphous waxy component of greases.

Clay contact rerun unit: In this plant, the dewaxed lubricating oil intermediate distillates are mixed with a special absorbent clay and then rerun, under vacuum, for production of stable and specified color lubricating oils.

No Avgas to Be Made

An unusual feature of the operation of the Fawley refinery, particularly as compared with refining experience in the U. S., is that no aviation gasoline will be made there. The Esso Petroleum Co. decided against this because installation of the special units required would have delayed the entire project. Also, company executives feel that, with the increasing use of jet propelled aircraft, demand will lessen for the present conventional fuel. The plant will make a large volume of many types of finished products in the distillate class, including jet fuels to the two specifications of the British government, and its operations are flexible enough to greatly increase its output of jet fuels as requirements increase for this type of aviation fuel.

The use of copper chloride sweetening, hypochlorite for finishing treating for kerosine and jet fuel, sulfur dioxide solvent extraction for treating kerosine and other treating methods makes it possible for the Fawley refinery to avoid entirely the use of sulfuric acid in its operations, which has materially reduced the problem of waste disposal. The refinery also will aid in the conservation of sulfuric acid by installing a sulfur recovery plant, to produce 12,000 tons per year of chemically pure rock sulfur from the high sulfur gaseous products of the catalytic cracking operation, as it is briefly described elsewhere in this article.

The first concrete to be poured on the Fawley refinery site was for the permanent maintenance building. This structure, 800 ft. long and 180 ft. wide and covering more than three acres, served during the construction period for offices, warehouse and factory for much of the fabrication which was done on the job. Now, assuming its permanent function, it incorporates craft shops of all kinds, warehouse for materials and supplies, latest types of machine tools, three overhead cranes, and offices for engineers and a clerical staff.

The waste water separator has a capacity of 75,000 gals. per minute. Salt water used for cooling is returned to Southampton Water after contaminants are removed, and the oil recovered by trapping is returned for further processing. A feature of the separator is a sludge hopper into which the bottoms from the separator basins can be pumped. They are stripped with steam to remove the oil.

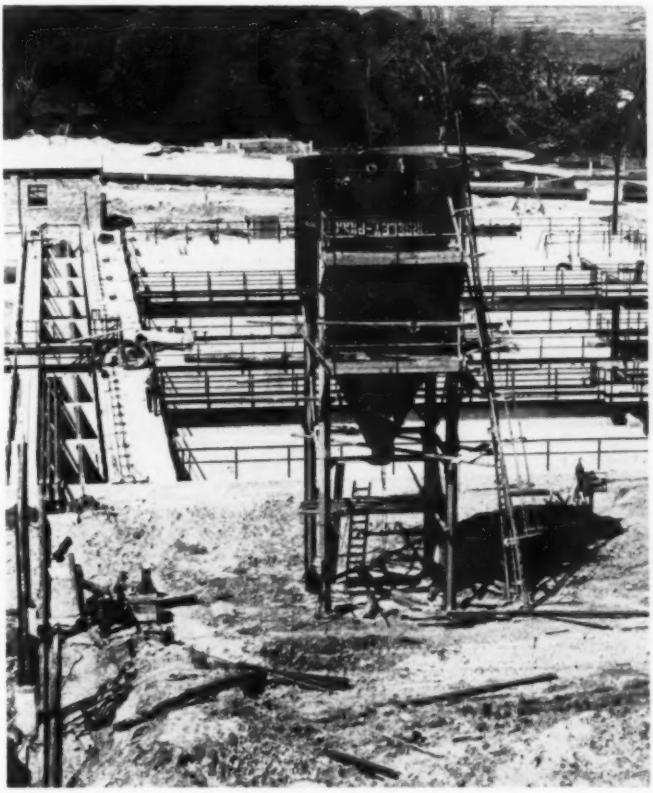
Reasons for Selecting Site

The site of Fawley refinery is nearly 500 acres in what had been virgin forest since the time of William the Conqueror. This location was chosen for various reasons. It adjoins the company's old refinery. Skilled labor was available in the Southampton area. The structure and elevation of the land offered the quickest and lowest cost development for refinery construction. Southampton is considered one of the finest harbors in the world. The unique double tide and slow moving current of Southampton Water enable fully laden ocean tankers to swing, berth or unberth at any hour of the day. In an emergency tankers can quit at any stage of the tide. The berthing site is fronted by 2500 ft. of open navigable water and it is isolated from other shipping activities of the area. Fawley also is in economical position to receive crude from the Middle East and from the oil pipelines at the eastern end of the Mediterranean, and offers short haul to the largest consuming territory, London and vicinity.

The first tree was cut on the Fawley refinery site on July 4, 1949. After the ground was leveled one of the first steps was to construct a camp capable of housing 750 workers, lay down a railroad system of several miles of track, install a field telephone system, drill water wells and erect many miles of fencing.

To provide the vast quantities of concrete required for the deep foundations for the large size refinery equipment, a plant was set up with a capacity of 140 cu. yds. of concrete per hour.

Because of the large diameter and overall weight of many of the processing units, fabrication in the shop and the shipping to the site of completed structures was impractical and costly. Fabrication on the site was planned as a basic step in the construction sequence. Formed and cut steel plates, sized to expedite marine and rail shipping to the site, were forwarded from many fabricating shops both in the U. S. and Great Britain. Upon arrival at Fawley the plates were located at or near the process unit of which they were to be a part. This facilitated their moving into position for the welders to fabricate on the ground into a finished section ready to fit into place. Since the labor schedule indicated a need for more welders than were



Sludge hopper in which bottoms from the oil-water separator in the background are stripped with steam to recover entrained oil

available at the site, a welding school was organized and set up on the grounds.

Three heavy duty derricks were used to lift the large steel sections into place. One derrick was 265 ft. above grade and represented a vertical leg of 165 ft., with a boom of 140 ft. fixed in position on a structural steel platform 100 ft. high. One of the very light and yet significant duties of the derricks was to lift the portable X-ray equipment so that photographic analysis could be made of the welding after the sections were welded into position. One of the derricks was later dismantled and set up as gin poles for raising into position the heaviest and largest single piece of equipment—the 135-ton debutanizer tower which stands 113 ft. above grade.

Although the main contract for the procurement of the major units and their erection was placed with Foster Wheeler Corp., the actual work is being executed by Foster Wheeler Ltd., a British affiliated company, and many sub-contracts were placed in the United Kingdom, resulting in a large dollar saving. The major processing units, including the catalytic cracking plant, pipe stills, Edeleanu unit and some others were obtained from the U. S.

Esso Petroleum Co. is taking unusual steps to insure that the beauties of the countryside around Fawley and Southampton Water are preserved. The refinery and adjoining buildings will be set within wide lawns, and a belt of trees and flowering shrubs will screen the plant from the road on the landward side. Stringent measures are being incorporated to avoid both water and atmospheric pollution.

Tons into Barrels

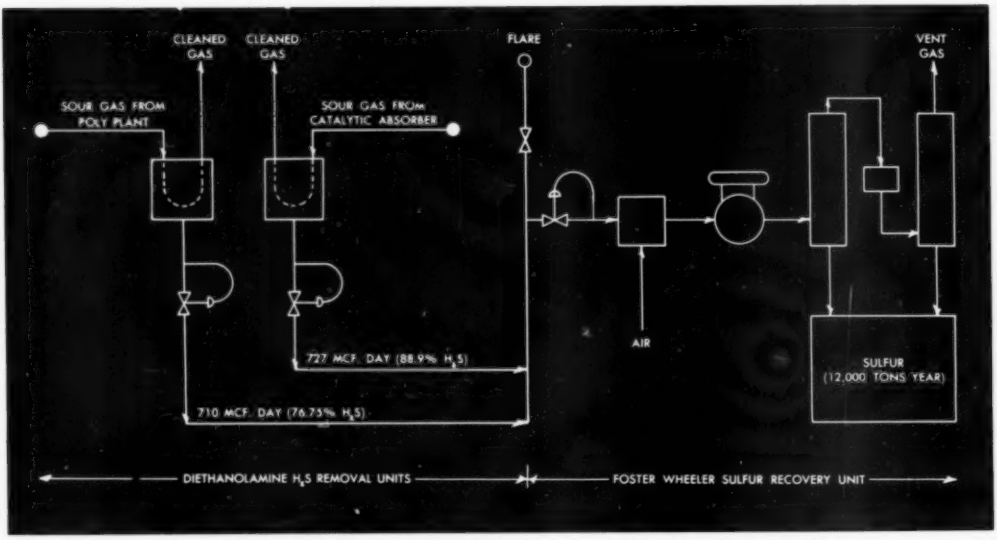
Potential output of Esso Petroleum Co.'s Fawley refinery is officially reported as 6,000,000 metric tons annually. Converted into barrels daily the following is the approximate proposed output of principal products:

Product	B D
Gasoline and Naphtha	42,500
Kerosine and Distillate	32,000
Residual fuel	41,000
Asphalt	2,000

The above is on the basis of the following conversion factors for 1 metric ton; 8.5 for motor gasoline, 7.75 for kerosine, 7.25 for distillate, 6.66 for residual fuel oil, 6.06 for asphalt. Conversion factor for the crude the plant will process (Middle East, 42° API gravity), is 7.73.

Acknowledgment

The data and illustrations used in this article were made available through Standard Oil Development Co. and the Foster Wheeler Corp. of New York.



Fawley Will Make 12,000 Tons of Sulfur Annually

A LARGE sulfur recovery plant, designed to produce about 12,000 long tons of chemically pure elemental sulfur annually, will constitute another important stage of construction at Fawley. It is scheduled to be completed in 1953.

Two separate "sour" gas streams from processing operations in the Fawley refinery will supply hydrogen sulfide for the sulfur recovery operation, as indicated in the flow diagram above.

Gas from the polymerization unit will be cleaned by absorption in diethanolamine in one of the hydrogen sulfide removal units. From this stream will be obtained 710,000 cu. ft. (at 100° F.) of acid gas per 24 hours, containing 88.9% H_2S.

The second source, gas from the catalytic absorber, will be cleaned up by a second H_2S removal unit, from which will be obtained 727,000 cu. ft. of acid gas per 24 hours, containing 76.75% hydrogen sulfide.

The mixture of these two acid gas streams will be charged to a Foster Wheeler sulfur recovery unit. There it will be converted to elemental sulfur, following the usual reaction of burning roughly a third of the H_2S to SO_2, as follows:

$$H_2S + 3O \rightarrow H_2O + SO_2$$

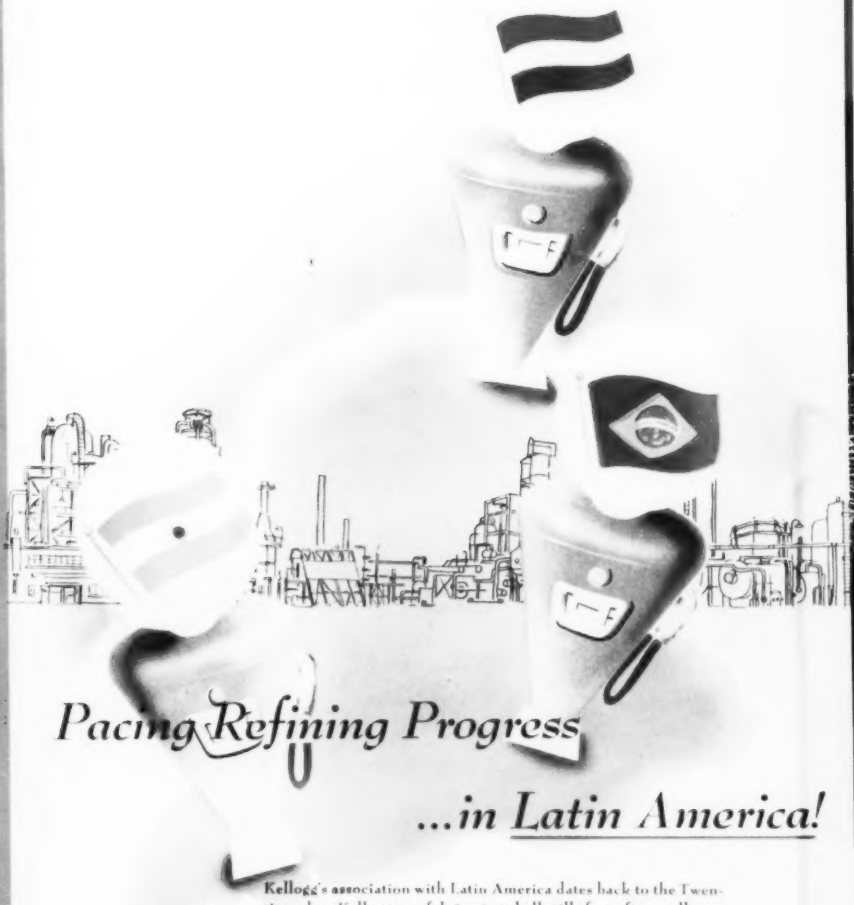
and then reacting the remaining H_2S with the SO_2:

$$2H_2S + SO_2 \rightarrow 2H_2O + 3S$$

Foster Wheeler has already designed and built at least six such sulfur recovery plants in the U. S., which today are recovering a total of nearly a quarter of a million long tons of sulfur annually.

SERVICE LEDGER
1901-1951

ANGLO-IRANIAN OIL CO. LTD.
ARGENTINE GOVERNMENT OIL FIELDS
ARGENTINE MINISTRY OF WAR
ATLANTIC REFINING CO.
ATOMIC ENERGY COMMISSION
BRITISH AMERICAN OIL CO. LTD.
CANADIAN OIL REFINERIES, LTD.
CALIFORNIA REFINING CO.
CHAMPLIN REFINING CO.
CIE. DE RAFFINAGE SHELL-BERRE
CIE. FRANCAISE DE RAFFINAGE
CIE. INDUSTRIELLE DES PETROLES
CITIES SERVICE OIL CO.
CITIES SERVICE REFINING CORP.
COLGATE-PALMOLIVE-PEET
CONSOLIDATED REFINERIES, LTD.
CONTINENTAL OIL CO.
CORY BROTHERS & CO., LTD.
CREOLE PETROLEUM CORP.
DIAMEL CORPORATION
EL DORADO REFINING CO.
ESSO STANDARD OIL CO.
GENERAL PETROLEUM CORP. OF CALIFORNIA
GLOBE OIL & REFINING CO.
GULF OIL CORP.
HUMBLE OIL & REFINING CO.
IMPERIAL CHEMICAL INDUSTRIES
IMPERIAL OIL LTD.
KANOTEX REFINING CO.
KENDALL REFINING CO.
LEVER BROS.
LION OIL CO.
MAGNOLIA PETROLEUM CO.
MARINE OIL REFINERS OF AFRICA, LTD.
MATHIESON CHEMICAL CORP.
McCOLL-FRONTENAC OIL CO., LTD.
MID-CONTINENT PETROLEUM CORP.
MITSUBISHI OIL CO., LTD.
NATIONAL PETROLEUM COUNCIL OF BRAZIL
PAN AMERICAN REFINING CORP.
PENNZOIL CO.
PHILLIPS PETROLEUM CO.
POLYMER CORP., LTD.
PURE OIL CO.
SHELL CHEMICAL CORP.
SHELL OIL CO.
SHERWIN-WILLIAMS CO.
SINCLAIR REFINING CO.
SKELLY OIL CO.
SOCIETE DES RAFFINERIES DE PETROLE DE LA GIRONDE
SOCIETE GENERALE DES HUILES DE PETROLE
SOCIETE INDUSTRIELLE BELGE DES PETROLES
SOCONY-VACUUM FRANCAISE
SOCONY-VACUUM OIL CO.
S. R. SQUIBB & SONS
STANDARD OIL CO. (INDIANA)
STANDARD OIL CO. (OHIO)
STANDARD OIL CO. OF CALIFORNIA
SWIFT AND CO.
TEXAS CO.
UNION OIL CO. OF CALIFORNIA
UTAH OIL REFINING CO.
WASATCH OIL CO.
WOOD RIVER OIL & REFINING CO.



Pacing Refining Progress ...in Latin America!

Kellogg's association with Latin America dates back to the Twenties, when Kellogg was fabricating shell stills for refiners all over the world. These early contracts led to the design and construction of many key sections of the original refinery at Aruba. In subsequent years, as this refinery was continually modernized, Kellogg installed thermal cracking and hydrogenation units and also Latin America's first Fluid catalytic cracker.

Today finds Kellogg active further South. Within the year, the company has put on stream Brazil's first complete cracking refinery . . . started an expansion to double its capacity, also adding cat poly and LPG facilities . . . and initiated work on a 10,000 BPD complete refinery at Rio de Janeiro.

Concurrently, in the Argentine, Kellogg has placed a complete toluene plant on stream at Campana and started construction on a 30,000 BPD refinery at La Plata. This project includes the most advanced high-octane processes—Fluid catalytic cracking, catalytic polymerization, and alkylation—as well as topping, vacuum flashing and delayed coking.

THE M. W. KELLOGG COMPANY

A SUBSIDIARY OF PULLMAN INCORPORATED

for fifty years an integral part of processing history

NEW YORK JERSEY CITY LOS ANGELES TULSA HOUSTON TORONTO LONDON PARIS

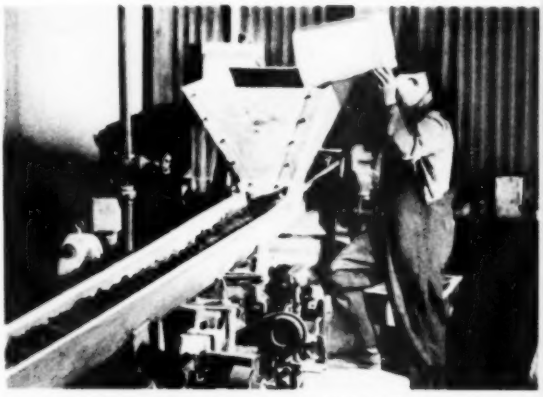
Portrait at

This year is Kellogg's fiftieth of service to industry. At this time naturally, as a group of men—known collectively to the modern business world as The M. W. Kellogg Company—we can think back nostalgically. We can remember the chimney stacks

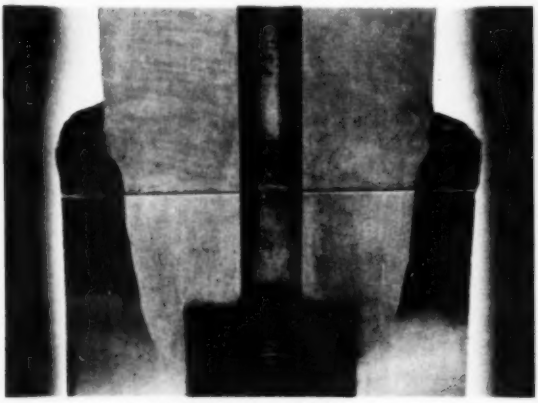
Meeting the Toughest "Specs"...

In previous issues of this magazine, camera "portraits" of M. W. Kellogg today have highlighted the major aspects of Kellogg's broad research, development, engineering and procurement activities.

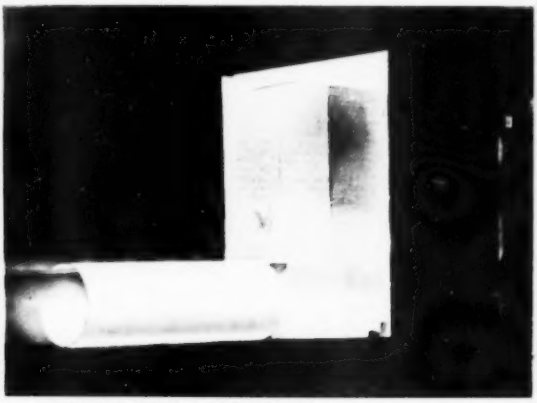
This month, Kellogg's manufacturing operations, largely centered in Jersey City, New Jersey, come within the lens. Some of these operations are continuations of various phases of the original metal fabricating business from which the modern company stemmed. Others had their inception as outgrowths of Kellogg's research and development activities... when the company undertook the manufacture of new equipment and materials which were not commercially available but which were required to meet improved engineering specifications.



1. *WILLINGNESS TO PRODUCE SPECIALTY ITEMS* is readily apparent in this catalyst manufacturing phase of the company's operations. When cat poly and hydroforming were being introduced into commercial refining, there was no readily available source for the special catalysts desired. Consequently, Kellogg undertook their manufacture and, today, two plants in Jersey City continue to produce these specialized materials.



4. *FROM THE SAME MILL* came a special transition piece (test piece illustrated) which solved a problem in the design of 1050 F power piping installations. The piece is used to join two types of alloy piping with widely varying coefficients of thermal expansion. It is so cast that the analysis of each end matches that of the piping to which it is joined. The result: elimination of excessive weld stress at elevated temperatures.



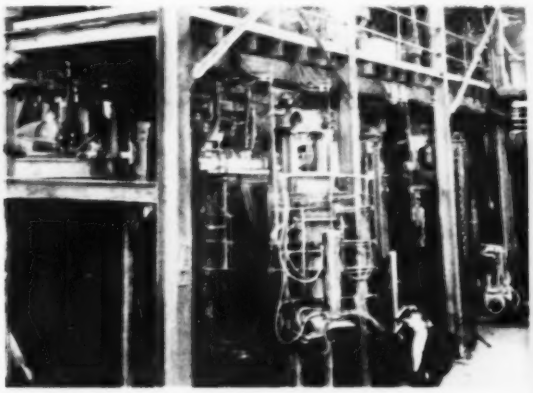
5. *TOWERS, VESSELS, EXCHANGERS* and piping, however, are the principal products of the shops. Facilities are complete, from plate forming to precision machining. The shops are employed in three major ways . . . to build prototypes of Kellogg developed equipment; as a prime supplier on refinery construction contracts; and to manufacture custom-made equipment for direct sale to the process industries.

Fifty... no. 8

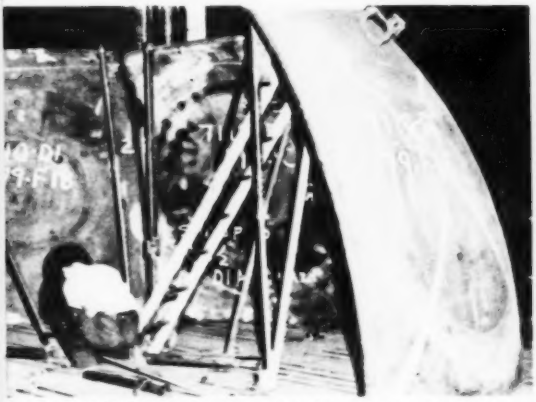
KELLOGG
1901 1951
50th Anniversary

we built in 1901 . . . the first crude vessels for oil refiners in the 'teens . . . our first combination unit. The forty-odd Fluid cat crackers built in these years. But, after all, The M. W. Kellogg Company is only a factor as it is able to serve industry today. For that reason, we are presenting this series of monthly camera studies which document our belief that a truly integrated organization can better serve industry to achieve greater earning power. This is No. 8 in the series.

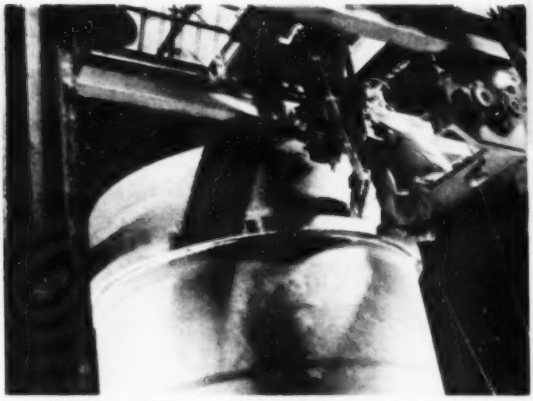
2. *A SIMILAR SITUATION* placed Kellogg in the refractories and refractory products business. These products play so large a part in most industrial processing projects that years ago the company developed materials specifically suited for process plant applications. Currently, these materials are made to Kellogg specifications and sold under such trade names as Ignisite, Kel-crete, Kel block and Thur Ma Lox.



3. *PROBABLY THE LAST THING* you would expect to find at Kellogg would be a steel mill. Yet, this unique electric steel plant at Jersey City, outgrowth of Kellogg metallurgical research, is continuously producing alloy ingots with exceptional mechanical properties. The process assures a constant analysis throughout the cross-section of the ingot which explains why jet turbine manufacturers are steady customers for this steel.



6. *LARGE PROCESS VESSELS* call for different techniques because it is frequently impossible to ship them completely assembled over inland rail routes. Kellogg has developed two solutions to this problem. First by floating vessels to their final locations over inland waterways. Second, and more recently, by knockdown fabrication of carefully matched segments in the shop as shown in the accompanying picture.

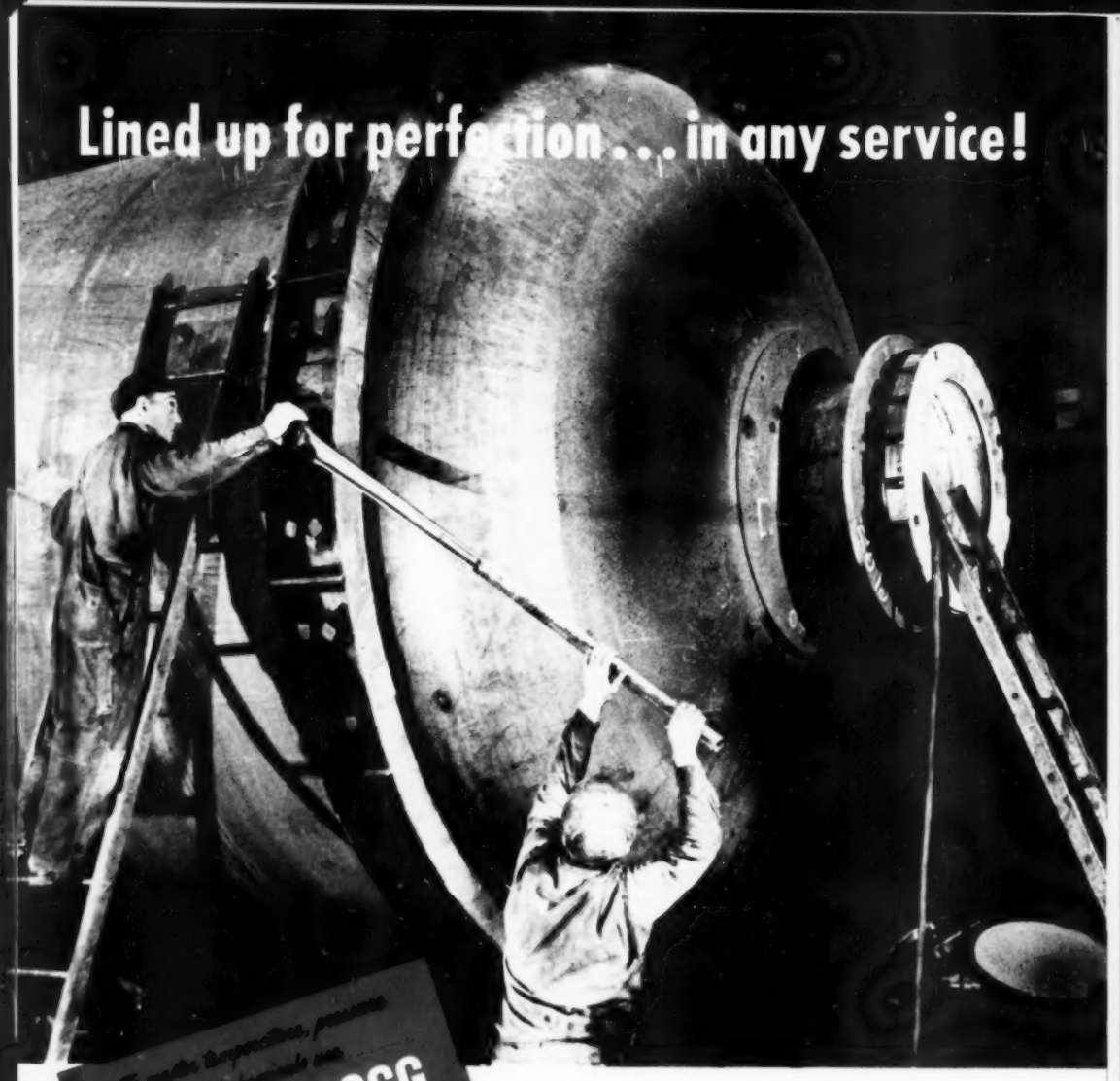


7. *THE IMPORTANT ROLE OF WELDING* in the fabrication of equipment is underlined by the fact that the company maintains a special *Welding and Welding Practices Research Group*. Since 1931, this group has been closely associated with such developments as continuous welding, inert gas welding and other techniques with the result that today Kellogg's equipment is among the most modern available.

NEXT MONTH

. . . in the ninth of this series of camera studies of M. W. Kellogg today . . . you will glimpse a few of the specialized, and in many instances unique, techniques employed to improve the quality of manufactured products.

Lined up for perfection . . . in any service!



To make temperature, pressure and chemicals run

M. W. KELLOGG

pass specified

In digestors for pulp mills . . . special towers for fatty acid splitters . . . refinery vessels, large and small . . . in equipment for any processing task, Kellogg's accurate line-up techniques, preparatory to welding, pay off in peak operating performance and longer service life.

Pressure Vessels
Vacuum Vessels
Fractionating Columns
Drums and Shells
Heat Exchangers
Process Piping
Hi-pressure—Hi-temp Power Piping
Bends and Headers
Giant One Piece Bends
Forged and Welded Fittings
Radial Brick Chimneys

Continuing Study of behavior of metals under stress at high temperatures has produced valuable design data.

Shop Layout Craftsmen are fully experienced in vessel fabrication from nozzle positioning to "knockdown" fabrication for field assembly.

Extensive Facilities from forming of plate to final machining of precision surfaces permit complete fabrication under the same roof.

Special Welding Techniques and stress relieving methods assure equipment performance even under severest operating conditions.

Rigid Quality Control, devised by specialists, including chemical and micro analyses as well as mechanical and non-destructive testing.

NEWS FOR OPERATORS IN WESTERN CANADA

The Canadian Kellogg Company Ltd. has established complete shop facilities for the fabrication of all types of piping at EDMONTON, Alberta. Inquire directly or through any Kellogg or Canadian Kellogg office.

The M. W. Kellogg Company *(A Subsidiary of Pullman Incorporated)* New York, Jersey City, Los Angeles, Tulsa, Houston, Toronto, London, Paris

Graphitization Appraised by Metallurgist

PERTINENT data on the deterioration of steel through graphitization after long service at high temperatures was developed by the power industry as the result of a survey inaugurated after a piping failure in 1943. This study included carbon steel, although the power plants use principally a carbon-molybdenum steel in their steam lines. The operating conditions include pressures well over 1000 psi, and temperatures as high or higher than those in catalytic cracking units.

The tendency for the iron carbide to decompose into one of various forms of graphite depends primarily upon the type of steel, the power industry report states. However, one operating condition—the extent of temperature swings—was found to be a considerable factor in the occurrence of graphitization. The desirability of limiting the extent and duration of swings above the design temperature was emphasized. Temperatures to which the steel was subjected in operations should not exceed design temperatures by more than 25° F., it was brought out.

The power industry's investigation concluded that commercial steels could be specified which would resist the usual graphitization process at temperatures higher than 1000° F., and which could be welded, fabricated, and installed by conventional methods.

The following temperature limits were suggested as reasonable for pipe materials as based on service experience of 60,000 hrs. in the case of carbon steel and high aluminum carbon-moly steels:

Carbon steel, low and medium carbon	825° F.
High aluminum carbon-moly steel (1.5 to 2 lbs. Al. per ton)	900° F.
Low aluminum carbon-moly steel (0.5 lb. ton)	925° F.
Chrome-moly (0.5% chrome, 0.5% moly.)	950° F.

The power industry's study of graphitization was conducted by a joint group from the Edison Electric Institute and the Association of Edison Illuminating Companies. The research phase of the program was done at Battelle Memorial Institute, Columbus, Ohio. The investigation followed the failure of a welded 0.5% molybdenum steel steam pipe at the Springdale Generating Station of the West Penn Power Co. in 1943.

G. V. Smith, Research Laboratory, United States Steel Corp., Kearny, N. J., made a critical survey of the investigations reported of this case, including a bibliography of some 30 articles.* The results of his review, as summarized in his paper, appear below:

"Effect of Deoxidation Practice.—Abundant evidence has accumulated to show that a relatively large addition of aluminum, greater than perhaps 1 lb. per ton of steel, promotes susceptibility to graphitization in both plain carbon and molybdenum steels. On the other hand, steels of either type, when deoxidized with less than perhaps 0.5 lb. aluminum per ton of steel, are highly resistant. Claims that there exists a correlation between the residual aluminum, but not the alumina produced by deoxidation, and susceptibility to graphitization have been advanced; this, however, appears not to be unequivocally established. Regarding the claimed relation between "abnormality" in the carburizing test and susceptibility, it appears to be fairly well established that most steels which graphitize readily are abnormal, though there are notable exceptions; but, since the converse is not true in many instances, it would seem unnecessarily restrictive to use only "normal" steel in service at elevated temperature, particularly since a strictly "normal" steel is not commonly obtained even when the aluminum addition is severely restricted.

"Effect of Composition.—The greater the carbon content the greater is the rate of graphitization. Both molybdenum and chromium appear to inhibit graphitization. This latter element is widely considered to be the best means of avoiding graphitization; the necessary amount seems to be at least 0.5%, and probably slightly greater. The influence of other elements, such as titanium and vanadium, is also being investigated.

"Effect of Prior Heat Treatment.—It appears fairly well established that the chain type of graphite, such as that in the failure at Springdale Generating Station, tends to occur when the initial structure is one resulting from normalizing at relatively high temperature, whereas the nodular, more uniformly dispersed graphite is more likely to occur in the pearlitic structure resulting from normalizing at lower temperature. It also appears fairly well established that in molybdenum steel, the structures resulting from slow cooling are more likely to form graphite than are those resulting from fast cooling, martensite being quite resistant. The converse appears to be the case for carbon steel, martensite being most subject to graphitization.

"Effect of Welding Conditions.—Very little direct experimentation has been conducted on the effect of welding conditions on susceptibility to graphitization, and the incidental observations reported are not in complete agreement. It seems certain, however, that welding conditions cannot be of more than subsidiary importance, and that their principal role is in setting the temperature gradient.

"Effect of Post Treatment After Welding.—It appears well established that post treatment at 1300° F. for 4 or more hours will effectively reduce the amount of subsequent localized graphitization, and in some instances will completely prevent its occurrence, particularly if the material is normalized at about 1650° F., prior to welding. More recent work has indicated that post treatment at 1400° F. may serve just as well or better than post treatment at 1300° F.

"Effect of Time and Temperature of Exposure.—The shortest time and lowest temperature for precipitation of graphite depends in large degree on factors such as chemical composition, deoxidation practice employed and initial heat treatment; it is therefore impossible to set any specific time and temperature conditions applicable in all cases; but, as a rough approximation, it may be said that in readily graphitizable carbon or molybdenum steel, with 0.10 to 0.20% carbon, graphite appears in 1000 hr. at 950 to 1000° F.

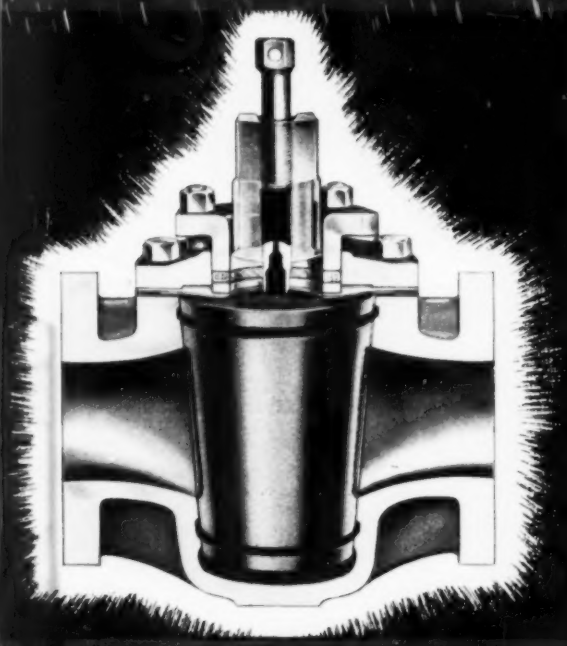
"Effect of Stress and Deformation.—Stressing at elevated temperature or plastic deformation at ordinary temperature (presumably also at elevated temperature) accelerates graphitization. The formation of graphite along well-defined planes has been attributed to localized deformation; but this form of graphitization has not yet been reproduced by laboratory experiments."

*Smith, G. V., "Graphitization of Low-Carbon, Low-Alloy Steel—An Appraisal of the Literature", Welding Journal of the American Welding Society, June, 1948, pg. 277s.

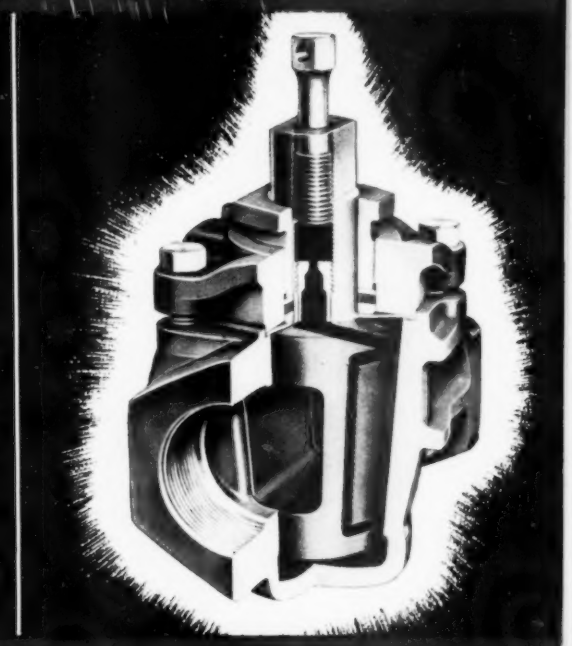
A Refiners' Problem, Too!

As reported in the July issue of PETROLEUM PROCESSING, the high temperature deterioration of carbon steel in vessels and piping is also a major problem to the refining industry. Oil companies are being asked by the API Refinery Equipment Committee to cooperate in a survey of the occurrence of graphitization in such service. For further details, see "Effect of Temperature on Carbon Steel in Refinery Vessels Being Surveyed," by V. B. Guthrie, PETROLEUM PROCESSING, July, 1951, pp. 719-721.

THESE VALVES "*can take it!*"...



NORDSTROM BOLTED GLAND TYPE
Made in sizes from 4" and larger
in semi-steel and Nordco steel



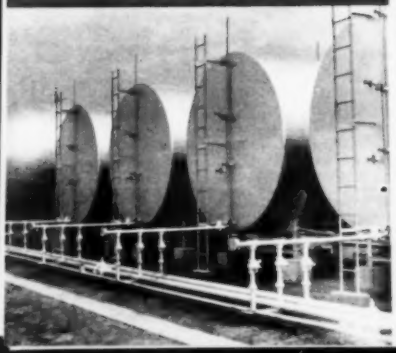
NORDSTROM SCREWED GLAND TYPE
Made in sizes from 4" and smaller
in semi-steel and Nordco steel

UNEXPOSED SEAT Fully protected from the line fluid, thereby avoiding corrosion and erosion

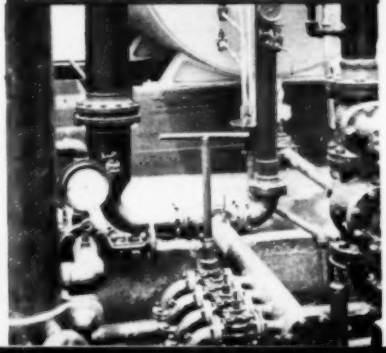
POSITIVE ROTARY ACTION Quarter-turn of tapered plug fully opens or closes

AUTOMATIC LUBRICATION Hypermatic insures constant feed and pressure

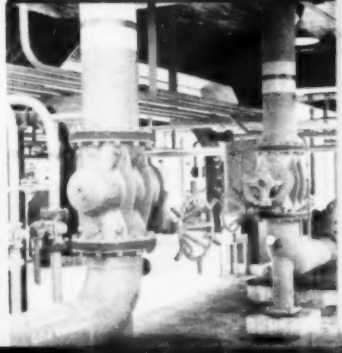
Nordstrom valve manifold on rundown tanks in a refinery



Nordstrom valves on sample lines of acid treater settler and acid lines



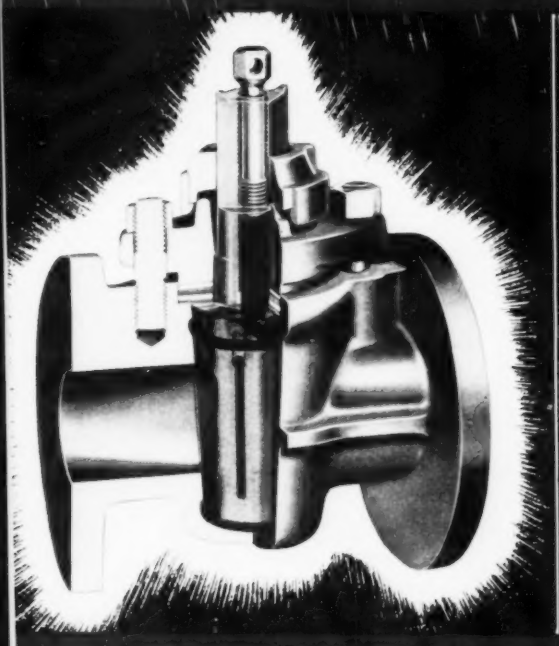
Nordstrom valves on emulsion lines in a refinery



All Temperatures . . . . . —150° to +1000°F.

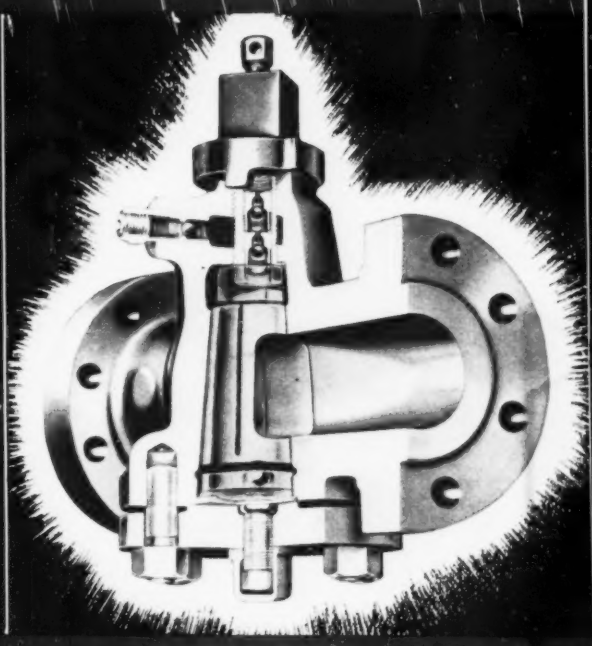
All Pressures . . . . . VACUUM TO 15,000 LB. TEST

All Ways IN TOUGHEST SERVICES



NORDSTROM 2-BOLT TYPE

Made in sizes 4" and smaller in semi-steel



NORDSTROM HYPRESEAL TYPE

Made in sizes from 1½" to 24" in Nordco carbon and alloy steel for pressures to 15,000 lb. test

Start replacing troublesome valves with Nordstroms

The best offense against leakage is a good defense. Bring up your present lines to top-notch condition by replacing old, troublesome valves with Nordstroms rather than trying to "patch" with valves that will again need replacement. By using Hypermatic lubricant, Nordstroms require only occasional attention, because Hypermatic gives the valves automatic lubrication. They maintain lubricant pressure for longest periods so they keep in excellent condition, ready to operate, always easy to open or close. Nordstroms can be depended upon, in the toughest services, as attested by the countless installations in most of the Nation's pipe lines, and in practically every industry.

Ask for literature

Nordstrom Valves

Rockwell MANUFACTURING CO.

400 N. Lexington Ave., Pittsburgh 1, Pa.

Offices in all principal cities

Gun-applied Refractory Linings

Some practical answers to questions on their application and use in refineries

Practical data on refinery operating problems in various fields were given at the Questions and Answers session of the Process Heating Seminar of the John Zink Burner Co., in Tulsa May 26. Discussion of some of the questions is given below, selected from an exclusive wire recording of the proceedings as made by *Petroleum Processing's* Southwestern Editor, Dave Thornton, who attended the seminar.

Refractories

Please discuss the gun application of refractory linings.

WITSCHEY: "Great development appears to have taken place in the gun placement of castable refractory and insulating products as linings for catalytic regenerators, ducts, stacks and other types of enclosures for the petroleum and petrochemical industries. Methods differ as to materials and methods of anchoring and supporting. Finding extensive use is a composite type of lining in catalytic regenerator units.

"In this type of construction, anchor bolts (or studs) and vapor stops are welded to the inside surface of the shell. An insulating refractory castable then is gunned against the steel shell to proper thickness, commonly about 3 in. Hexagonal steel mesh then is welded to the anchor bolts or studs, which have been capped with small metal plates. The lining is completed by gunning a more abrasion-resistant castable through the hex mesh to form the remaining inch of lining, the surface of which is struck off to the upper surface of hex mesh. The resulting surface is a castable-metal composite, highly resistant to the abrasive action of moving catalyst beds or streams. In some instances a single insulating refractory castable has been used. The composite of two materials has been found more suitable, however.

"Often employed are field-mixed materials, consisting of mixtures of aggregate and high alumina cements. These mixtures offer the same disadvantage as encountered with field-mixed castables: namely, proper grain sizing is rarely attained. Control of ingredient quality and quantities are difficult. It would be difficult to determine the failures and inadequate performance resulting from field-mixed materials.

"Usually the castables developed for hydraulic placement have been used per se for gun application, and are identical to those refractory and insulating castables prepared for casting. It has been found that these mixtures are not entirely suitable, since their grain sizing and compounding is such that excessive rebound losses occur during placement. The difficulty is likely to be more than just the economic loss of materials and may result in variable properties of the placed material. Best results have been obtained with materials specially developed for gun application."

In applying the composite lining, how much is allowed for expansion of the shell of vessels?

WITSCHEY: "The first coat, which is insulating castable, is placed solid. There is no provision for expansion at all because there is a certain amount of "give" to it. Ordinary refractory brick when subjected to temperatures up to 1800°F—that is higher than a catalytic unit goes—shows an expansion of about 0.6%; a refractory castable only expands about 0.2% and its drying and burning shrinkage is about of the same order, so for practical purposes these are constant volume.

"However, in placing the sheets of hexagonal mesh, which are about 3 by 3 ft. or 3 by 4 ft., an allowance of 0.2% is made and a strip of $\frac{1}{8}$ in. board is placed between each sheet. This allows for contraction but, in many cases, this is overlooked with no harmful results, to my knowledge."

What is the thickness of the abrasion-resistant castable?

WITSCHEY: "About 1-in. The hex mesh is $\frac{3}{4}$ in. thick, so there is about a $\frac{1}{4}$ in. of castable below it, since the surface is usually struck off even with the surface of the hex mesh."

What information is available to refiners for comparing the abilities of commercial refractories to re-radiate heat to the tubes, the so-called "emissivity characteristics?

WITSCHEY: "I have no way to list a numerical or quantitative comparison of all the refractory oxides available. The crystalline type of refractories—those made from synthetic oxides—have high radiating properties. I believe the radiating properties of some of the refractories also are tied in with their conductivity properties. For all practical purposes all the fireclay series are of comparable radiating properties, while the high-oxide refractories radiate more."

Is "vermiculite" mix used in any of the insulating castables?

WITSCHEY: "The refractory castables, of course, get their refractoriness from the type of aggregate used. The insulating castables use aggregate made from insulating fire brick or a porous type aggregate, including such materials as vermiculite, diatomaceous earths or other natural insulating materials, bonded with a suitable cement. Sometimes one of the 'lumnites,' or often the high early and sometimes special lumnite and other types of lumnite cements are used. There is a lot of development work in this line at present."

Can the premix, wet-type of gunite be used in the application?

WITSCHEY: "Yes, that type of application is being used for refractory

The Q. and A. Panel

Answering questions at the Q. and A. session of the John Zink Process Heating Seminar were:

R. H. Hayman, W.H.& L.D. Betz., Philadelphia

Harold Born, Born Engineering Co., Tulsa

L. B. Sutherland, C. F. Braun & Co., Alhambra, Cal.

Ray Witschey, A. P. Green Fire Brick Co., Mexico, Mo.

J. L. Parker, Girdler Corp., Tulsa

J. B. Dwyer, M. W. Kellogg Co., New York

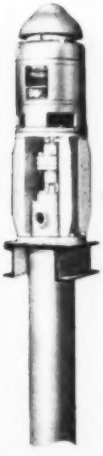
F. D. Fuqua, Koch Engineering Co., Wichita, Kans.

Boiling point temperatures and limited NPSH pose no problem for these VMT pumps!

When pumping fluids at boiling point temperatures, the problem of sufficient net positive suction head often requires expensive installation to raise the vessel from which the pump would draw or to excavate a pit to lower the pump.

This is eliminated with the BJ "VMT" pump because the vertical multi-stage pumping unit is mounted in a barrel from which it takes a suction. The base of the pump is at ground level while the length of the barrel is determined by the NPSH requirement.

The "VMT" pumps (shown above) serving as boosters from gasoline tank farm to main line stations are just one of the many successful applications for refineries, pipe lines, fueling stations, power plants, and process industries. For more detailed information on how the "VMT" may solve your pumping problem, call your local BJ sales office or send the coupon below.



FILE FACTS:

- Capacities to 5000 gpm. Heads to 250 psi. Temperatures from sub-zero to 750° F.
- Handles corrosive or non-corrosive liquids
- Radial forces balanced at all speeds
- Adjustable coupling for easy, accurate impeller setting

Also available in the smaller "VLT" model (capacities to 110 gpm). Provides the same basic construction and installation advantages as the "VMT," yet is priced for general purpose application.

Byron Jackson Co.

Since 1872

P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif.

OFFICES IN PRINCIPAL CITIES

BJ Pump Division, Dept. 24
Please send me Bulletin No. 51-6600 on your VMT pump.

NAME_____

FIRM_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

coating materials, it has been used in the siliceous refractories from slurries and also for spraying plain wet fireclay mixes on a wall.

"Generally, the premixed materials do not place to large thicknesses like the materials mixed at the gun nozzle and more generally the nozzle-mix is used in the oil industry with the light-weight materials. I know of no work to place the light aggregate types by pre-mixing; it can be done with heavy refractories, such as clay or silica, but it is not as yet practical with the light weight materials."

Preheated Forced Draft

What is the attitude of engineering companies toward the use of preheated forced draft in process heating?

BORN: "In a natural draft furnace the efficiency is limited by the inlet temperature. If you have a rather high inlet temperature, such as 700° F., this furnace could not approach the neighborhood of 75 to 80% net efficiency. Therefore, whether firing natural gas or fuel oil, or 10c or 30c gas, it is a question purely of considering first the fixed asset capitalization of what you are going to buy in order to evaluate any particular unit.

"One thing not to be lost sight of, in planning to install a mechanical forced draft heater (one requiring some type of tubular exchanger with a forced draft fan), is the question of deposits. I know of several cases where the first cost was justified on the basis of a "clean tube" evaluation, but after awhile the preheaters were not functioning as the result of corrosion. Consequently the efficiency they might have picked up was not being exhibited.

"There have been cases where the fuel fired produced vanadium oxide deposits which ate out the carbon steel preheaters. This would necessitate replacement with expensive alloy preheaters which might or might not have been justified under the initial conditions.

"To summarize, among the factors to be considered are fuel cost, first cost of the installation, any depreciation as the result of deposits and what is the best price."

PARKER: "Heaters used in the manufacture of hydrogen in quantities of up to 1800 Mcfd. do not use preheaters. But with the same furnace used in the manufacture of ammonia, we recommend a preheater where it proves out that the economics are favorable."

DWYER: "A number of factors must be taken into account in determining whether or not air-preheating will pay; fuel cost, payout time, temperature of inlet feedstock and even the nature of the feed. For example, if you have a high sulfur stock, necessitating use of alloy tubes in the convection bank, the picture will be changed.

The type of burners employed and the permissible heat transfer rate on the tubes must be considered because, when air preheat is used, the percentage of heat transfer absorbed in the radiant section is increased. If these heat transfer rates are limiting, a larger radiant section is required; this is the expensive part of the heater.

"Another important factor is the refiner's acceptance of the mechanical gadgets which generally are required in air preheating—a forced or induced draft fan or perhaps natural draft."

SUTHERLAND: "I believe one of the reasons this question is frequently raised is that we find air preheaters used in large boilers at central plants. We say if the utility and boiler people use preheaters, then probably we should be using them, too.

"We had an opportunity to check up on a case of preheater operation not long ago. We did not install air preheaters in this case, after an economic study such as suggested by Messrs. Born and Dwyer. Why? Merely because the economic study was conducted on a payout time of 2½ years, whereas most boilers are computed on a payout of 20 years; that makes a lot of difference."

Distance of Tubes from Wall

How far should the tubes be placed from the wall in the radiant section of the furnace from the standpoints of mechanical structure and heat absorption?

BORN: "If the wall is cleared by the tubes so there is no impingement, there is no effect on the tubular support. I am thinking here of the expansion occurring when the wall is heated and of the development of enough creep stress to rupture a tube. The wall clearance also has nothing to do with the metal temperatures on that wall.

"The distance depends on the size of the furnace, tube size, and tube distribution on the wall, among other things."

DWYER: "As the tubes are moved out from the furnace wall the cost of the hangers is increased, especially when large tubes, such as 6 in. pipe size, are involved. This might amount to a percent or so on the furnace cost. However, if there is an advantage in setting the tubes out from the wall to develop more circulation behind them, the question should be considered as to whether the circulation aids heat transfer or hurts heat transfer. If convection currents are such as to bring colder gases behind the tubes than are in center of the firebox, this would be harmful circulation.

"It is important in arranging multiple radiant section furnaces to make sure there is not a cold section followed by a hot section, resulting in cold gas coming over one bridgewall and dropping behind the tubes in the radiant section nearest the convection bank. There we are certain the convection currents are harmful."

For all high pressure testing

SEND FOR THIS BULLETIN!

THE Cooper-Bessemer intensifier offers new advantages, new economies, wherever pressure testing is desired . . . for boilers, piping, compressor cylinders, pumps, *all* kinds of pressure vessels and laboratory destruction tests.

Completely air driven, the new intensifier eliminates fire and explosion hazards of motor-driven equipment, and easily develops hydrostatic pressures up to 23,000 psi using air at 90 lbs.

The extreme compactness and portability of the unit is another obvious advantage. It weighs less than 80 pounds, rolls easily to any job or location. Its completeness, versatility and low purchase price will also appeal to you . . . will save you still more dollars!

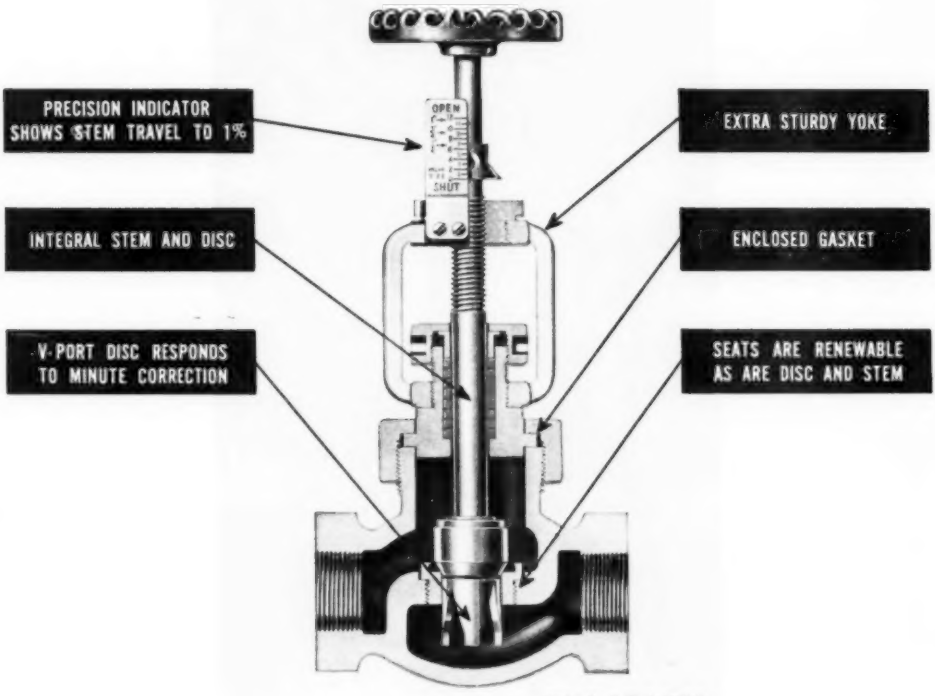
The intensifier is available in two sizes, —Model 10 for testing with water up to 10,000 psi and Model 23 for testing with oil up to 23,000 psi. For complete information send to any Cooper-Bessemer office for a new bulletin.

The Cooper-Bessemer Corporation

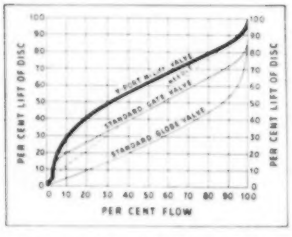
MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York City Washington, D. C. Bradford, Pa. Chicago, Ill.
San Francisco, Calif. Houston, Dallas, Greggton, Pampa and Odessa, Texas
Seattle, Wash. Tulsa, Okla. Shreveport, La. St. Louis, Mo. Los Angeles, Calif.
Caracas, Venezuela Gloucester, Mass. Calmes Engineering Co., New Orleans, La.

Assures greater precision in manual control of flow . . . the Honeywell HI-LIFT valve


PRECISION INDICATOR SHOWS STEM TRAVEL TO 1%
INTEGRAL STEM AND DISC
V-PORT DISC RESPONDS TO MINUTE CORRECTION
EXTRA STURDY YOKE
ENCLOSED GASKET
SEATS ARE RENEWABLE AS ARE DISC AND STEM
OPEN
SHUT

Write for Bulletin 242-2



Flow characteristics of the Honeywell Hi-Lift Hand Control Valve far surpass those of conventional designs . . . offer favorable comparison to the precision of such diaphragm-operated control valves as the Honeywell Series 700.

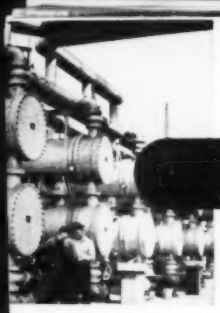
THE superior flow characteristics of the Honeywell Hi-Lift Hand Control Valve become immediately apparent when compared with conventional globe or gate valves.

In addition to the illustrated features, your comparison will show how the positive-seated, V-ported (or contoured) disc assures proportional flow throughout the entire lift of the stem . . . how the micrometer indicator is set to control flow *within one-hundredth of a turn of the stem* . . . how the unique construction prevents spinning of valve disc during operation, permits repacking with valve open and under pressure.

Write for Bulletin 242-2.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1910 Windrim Ave., Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
Valve Products



How to Use Three Fuels at Once

Refinery burner handles pulverized coal or coke, gases, and oil, tar, acid sludge, or pitch

By A. R. NICHOLS*

DURING the past few years, due to occasional periods of coal shortage as well as variations in the price structure and increased availability of fuel oil and natural gas, many power plants have converted from coal to oil or natural gas firing.

Converting to fuel oil under emergency conditions brings up numerous operating problems such as: 1) adequate oil burners properly installed, 2) fuel oil supply pumps and controls, and more important, 3) satisfactory facilities to keep the fuel oil hot. If any of these factors are not given proper attention, it is almost impossible to burn fuel oil and it is certainly impossible to obtain reasonable furnace efficiencies under any but the most favorable conditions.

There are a number of methods of burning combinations of fuels under the same boiler. One of the best is through use of a tri-fuel burner. Fig. 1 illustrates one of the more simple designs. This burner is now in use in the boiler plant of the Wellsville, N. Y., refinery of Sinclair Refining Co. in single cross drum Babcock & Wilcox boilers. They are equipped with: Fuller-Lehigh water walls covered with Bailey blocks; forced and induced draft fans; a tubular air heater; and they are of the dry bottom type for ash removal.

Boiler capacities are approximately 55,000 lb./hr. of 400 psig. steam at 625-650° F. when burning oil, coal, or gas. The coal-handling equipment consists of Fuller-Bonnet No. 7 pulverizers and 9200 cfm. mill exhauster fans. With this type of burner (Fig. 1) three fuels—coal, oil, and gas—can be burned simultaneously and in any proportion. The modern combustion control can do this, provided that the burner has been sized to supply maximum heat release on any single fuel.

The tri-fuel burner fires pulverized

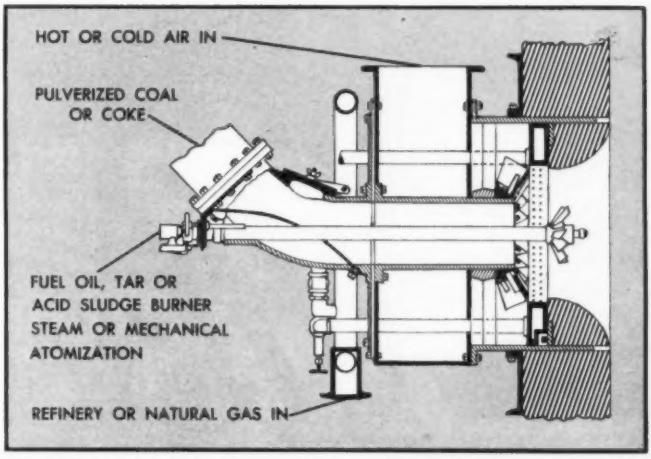

HOT OR COLD AIR IN
PULVERIZED COAL OR COKE
FUEL OIL, TAR OR ACID SLUDGE BURNER STEAM OR MECHANICAL ATOMIZATION
REFINERY OR NATURAL GAS IN

Fig. 1—Typical tri-fuel burner, designed to handle pulverized coal or coke; refinery or natural gas; and fuel oil, tar, or acid sludge

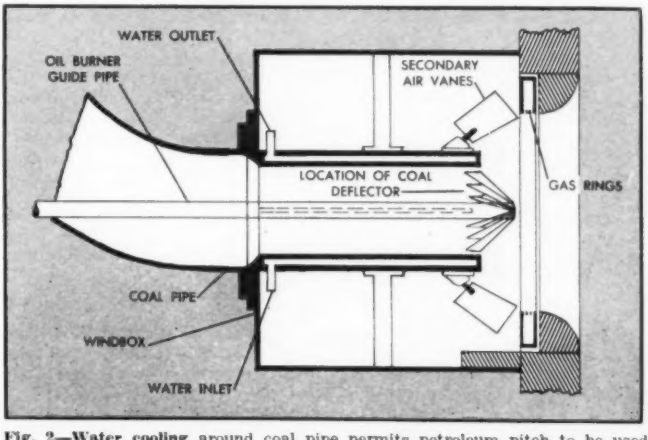
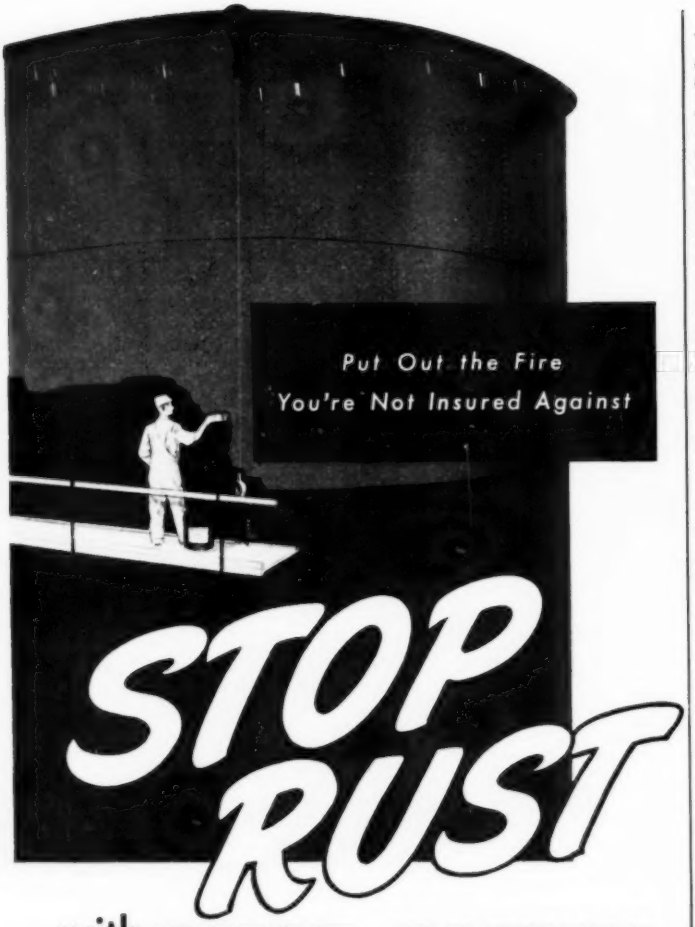


Fig. 2—Water cooling around coal pipe permits petroleum pitch to be used as a fuel in this design

* Mr. Nichols is combustion engineer, Sinclair Refining Co., Wellsville, N. Y.



with **RUST-OLEUM**

Rust is less spectacular than *insurable* types of oxidation. But it probably costs the oil industry many times the amount lost through fast, headline-making conflagrations.

To protect your tanks, pumps, derricks, refining equipment, buildings, roofs, fences—every rustable metal—against the relentless destructive action of rust—to keep every possible pound of new steel for the defense program—*adopt rust control with RUST-OLEUM as an important part of your maintenance program.*

RUST-OLEUM stops rust. It can be applied *even* over rusted surfaces. It is not necessary to remove all the rust. Just use sharp scraper and wire brush to remove loose rust and rust scale.

RUST-OLEUM can be obtained promptly from Industrial Distributors' stocks in principal cities of the United States and Canada. Write on your company's letterhead for complete catalog and nearest source of supply.

Available in many **COLORS** aluminum and white

RUST-OLEUM CORPORATION
2476 Oakton Street, Evanston, Illinois

coal through the center by means of an exhauster fan taking suction on the coal-air stream from the ball mill. The heat release in this case is a function of the mill capacity, fan size, and cross-sectional area of the discharge pipe. The coal-air mixture is given a rotary motion just before ignition takes place by means of a deflector that is attached to the end of the oil burner guide pipe. This deflector may be located for best firing results by moving the oil burner guidepipe in or out of the furnace throat. It is found that the deflector will usually rest at the end of the coal pipe, with about one-half the width of the blades inside and one-half outside. It has been shown in Fig. 1 as being well inside the burner throat, but that was for clarity in the print and was not intended to indicate the position during firing.

When it is desired to fire fuel oil, the burner is installed through the guide pipe which extends through the center of the coal stream. If fuel oil is fired with coal, it is common practice to supply about the same quantity of air from the exhauster fan by decreasing the amount taken from the mill and increasing the amount from the by-pass around the mill. When fuel oil is fired, it is necessary to decrease the amount of coal in order to balance on required heat release. This would decrease the air as well, if an adjustment were not made to keep total primary air the same. The deflector has the function of spinning the air into the atomized oil stream to facilitate combustion and produce a brilliant, compact oil flame that is easy to control and at the same time fire at high efficiency rates.

Natural or refinery gas is fired through a circular ring from a header arrangement. If the ring is installed in segments, it affords means of flame control by varying the amount of gas sent to each segment. On occasions where three fuels are being burned simultaneously it is an advantage to be able to vary the amount of gas supplied to each segment of the ring in order to keep flame control; i.e., keep the flame from being too long or too wide and thus impinge on the back or side walls. Under average conditions it is better to fire with all gas valves to the segments wide open, but occasionally on high firing rates it is necessary to make small adjustments on the gas ring for the reasons stated above.

Final control of the flame is made by adjustments to the secondary air vanes that extend in a full circle around the coal pipe. These vanes are of sufficient size to supply all the air required for combustion at full load when firing gas or oil, separately or together. The vanes are tied together and operate through one master control located on the outside of the windbox. For best results the

vanes are run well closed when firing all coal or a combination of coal and oil, and are opened to about a half-way position when gas is added. When the exhauster fan is not in operation, the secondary air then becomes primary air and the vanes are fundamentally wide open.

This burner is ideally arranged for the use of hot air through a pre-heater, and if coal is to be fired it is essential that hot air from some source be available to dry the coal.

An interesting test was made at the Wellsville refinery in March, 1950, to determine if petroleum pitch could be satisfactorily handled on a burner of this kind. The first test indicated that the low melting point of the pitch must be given serious consideration. After this problem was solved by using cold air through the mill, and by water-cooling the coal pipe as shown in Fig. 2, pitch was burned very satisfactorily. The flame was somewhat longer than that with pulverized coal, more nearly approximating an oil flame, but no trouble was encountered after these two changes were made. The test served to emphasize the value of the tri-fuel burner.

The tri-fuel burner has high value for those plants that are now using or contemplate the use of pulverized coal. The burner permits immediate substitution of oil or gas during periods of coal shortages. It also gives the plant engineer and the purchasing agent wide latitude in the selection of fuels according to variations in price structure. The burner is simple to handle regardless of the fuel or combination of fuels in use, and at all times the engineer can show high furnace efficiencies in the production of steam at low cost.

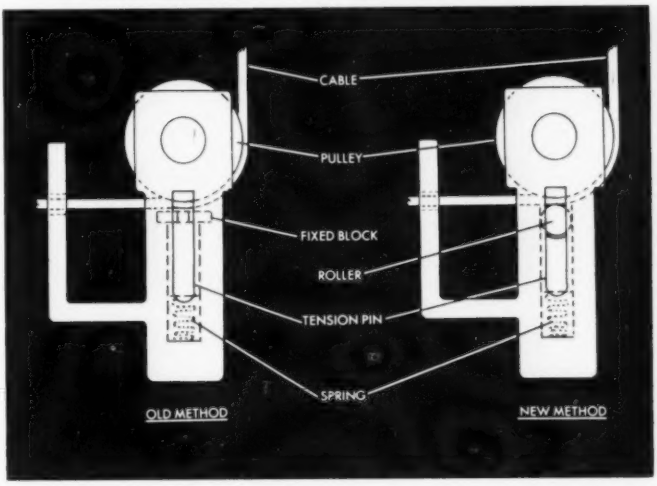
CASH for Your Ideas!

Want cold, hard cash for your own maintenance ideas? They're valuable today, what with materials and equipment growing hard to get, deliveries becoming longer, and "home-grown" ideas more helpful. PETROLEUM PROCESSING will pay you for your ideas, if accepted for publication, at our regular space rates—or higher if your idea is a really hot one.

So look around the shop or processing units and then send your stuff in to us, along with drawings, photographs, tables, and graphs. Don't worry about the writing. The idea is the important thing. We can dress up the notes and re-work the sketches where necessary. Send your contributions to:

Plant Practices Editor
PETROLEUM PROCESSING
1213 West Third Street
Cleveland 13, Ohio

Reduce Wear on Scaffold Cables



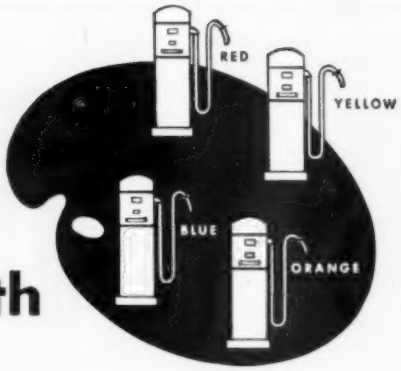
Excessive wear on scaffold cable can be cut by using the method shown above, which is in use at Socony-Vacuum Oil Co.'s Paulsboro, N. J., refinery as a result of a suggestion by employe Harry Calua. The existing tension block in the cable guide has been replaced with a roller so that the cable does not rub against a fixed surface. Socony has used a number of the improved guides on several types of scaffolding with satisfactory improvement in service life from the cables.

ONLY ONE MOVING PART..

A small, stainless steel valve that floats on the condensate load... keeps maintenance at a minimum. Continuous discharge under heavy loads, frequent under light loads, gets equipment hotter, sooner and keeps it hot. Over 600,000 Yarways already installed. Sold by distributors throughout the world.

YARNALL-WARING CO. 153 MERMAID AVENUE, PHILA. 18, PA.

(To obtain more data on advertised products see page 1028)



Assure uniform gasoline colors with readily soluble Du Pont Dyes

TELLING A STORY IN COLOR, this recording spectrophotometer measures the strength, shade and brightness of colors obtained with Du Pont Gasoline Dyes. To assure refiners of uniform tinctorial properties, Du Pont Gasoline Dyes are carefully checked by instruments like this.

THE COMPLETE LINE of Du Pont Gasoline Dyes includes red, blue, yellow and orange. These can be used individually, or mixed in combination to obtain virtually any desired color or shade.

THE UNIFORMITY of your own distinctive coloring is assured by the excellent solubility and high tinctorial strength of Du Pont Dyes.

FOR ADDED EFFICIENCY in your dyeing operation, one of the five conveniently located Du Pont District Laboratories will be glad to recommend the mixture and quantity of the dyes needed to obtain the colors you desire. They will also work with your own laboratory on other additive problems.

FOR FREE SAMPLES, get in touch with your nearest Du Pont District Office.

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

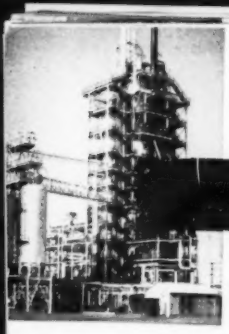
Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

District Offices: New York, N. Y. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · Los Angeles, Calif.

District Laboratories: Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · El Monte, Calif.

IN CANADA: Canadian Industries Limited — Toronto, Ont. — Montreal, Que.



PROCESSING PATENTS

New Developments in Processes and Products

By PETER J. GAYLOR
Editor, "The Technical Survey"

Pyrolysis of Propane Gives Unsaturates Suitable for Synthetic Drying Oils

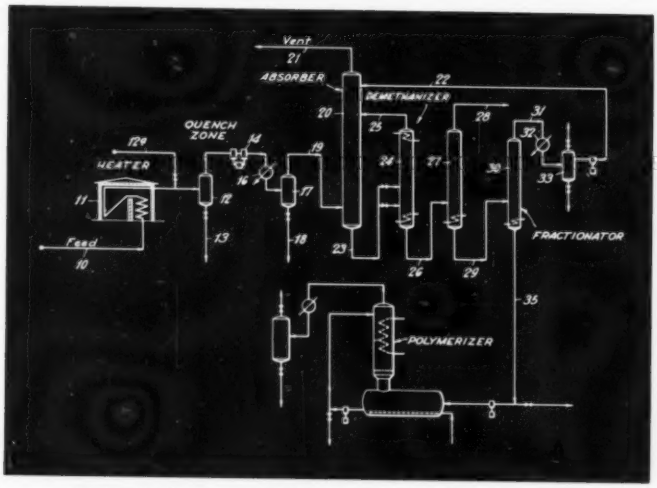


Fig. 1—Drying oil production by pyrolysis of C_3 hydrocarbons

THE pyrolysis of propane to produce unsaturated oils suitable as drying oils or drying oil extenders is described by Pan American Refining Corp. in its U. S. Patent 2,535,606.

As is apparent from the diagrammatic flow chart shown in Fig. 1, the propane, or mixture of propane and propylene, is injected in line 10 into tube furnace 11, where it is heated rapidly to about 1350-1550° F. at atmospheric pressure in chrome alloy tubes of small diameter. The hot gases emerging from the furnace pass directly into the quenching zone 12, where cold water from line 12a is injected to chill the gases and prevent further pyrolytic action. The gases are then conducted from quencher 12, where the temperature is reduced to about 100° F., into compressors 14, where the pressure is brought up to 500 psi.

The compressed gas is cooled in cooler 16 until a temperature of 250° F. is maintained in 17 so that only a small amout of heavy hydrocarbon condensate is separated and withdrawn at 18. Next, the gases flow through line 19 into absorber 20 countercurrent to a stream of absorber oil, the unabsorbed gases passing out through line 21. The absorber oil is a liquid fraction condensed in the process itself, and is supplied to the top of the absorber by line 22, preferably at 100-150° F. A pressure of about 500 psi is maintained in absorber 20.

The absorption product or fat oil is withdrawn from absorber line 23 and led into demethanizing tower 24, where it is stripped of methane and residual hydrogen, the latter gases being bled off at line 25. The demethanized hydrocarbons flow through line 26 to depropanizer 27, where the C_3 and C_4 hydrocarbons are separated by fractionation and taken overhead through line 28.

The depropanized absorber oil then is conducted by line 29 to fractionator 30, where a light fraction, mainly C_4-C_5 hydrocarbons, is withdrawn by line 31, condensed in 32 and collected in absorber oil supply tank 33, whence a stream is pumped by line 22 back to the upper part of absorber 20.

The material withdrawn by line 35 from the bottom of the fractionator 30 is highly unsaturated and has the following approximate inspections:

Refractive index (N_D^{25})	1.5031
Density (D_4^{25})	0.9296
Bromine number (Francis)	152
Iodine number (Wijs)	276
Gravity, °API	20.1
Distillation range, °F.:	
Initial	270
10%	304
20%	320
30%	336
40%	356
50%	380
60%	442
70%	482
80%	500
90%	630
Final boiling point	998

This unsaturated oil was polymerized by heating for 48 hrs. in a bomb at 500° F., and a product obtained from this operation had the following inspections:

Refractive index (N_D^{25})	1.527
Density (D_4^{25})	0.9745
Bromine number (Francis)	112
Iodine number (Wijs)	230

It was found that if the non-polymerizable fractions from the oil in line 35 were removed by stripping off the lower boiling portion, then the residue could be thermally polymerized under a slight pressure, particularly in presence of a Friedel-Crafts catalyst or clay. The yield is 130 lbs. of polymerized product from 370 lbs. of charge.

The product has good drying properties and can even be reduced to a solid by distillation. It was found that the portion of the oil boiling at 318-319° F. contained 36-63% of dihydrohydrindene, which could be condensed with maleic and hydride and then with glycol, etc. to give varnishes and thermo setting resins.

Patents Issued in July

The following classified listing gives the patent number, patentee or assignee, and a brief description of all patents believed to be of interest to the petroleum processing industries, as contained in the Official Gazettes of the U. S. Patent Office for July 3, 10, 17 and 24, Vol. 648, Nos 1-4.

Chemicals

U.S. 2,558,716 (The Texas Co.) Thiophene preparation from hydrocarbons, alcohols, or monohalohydrocarbons and sulfur dioxide.

U.S. 2,558,812 (Universal Oil Products Co.) Resin by condensing phenol, an alkyl aromatic hydrocarbon, and a polyenic hydrocarbon.

U.S. 2,558,844 (Petrocarbon, Ltd.) Photooxidation of aliphatic olefinic hydrocarbons.

U.S. 2,558,861 (Universal Oil Products Co.) Producing acetylene by pyrolytic conversion of hydrocarbons.

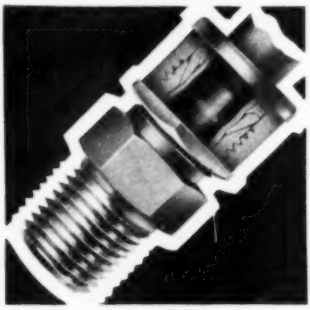
U.S. 2,558,882 (Universal Oil Products Co.) Petrolatum-like cycloalkylpolyethylene.

U.S. 2,559,083 (Pan American Refining Corp.) Decolorization of polyolefinic hydrocarbon

SWITCH TO

Swagelok*

TUBE FITTINGS



Bothersome small leaks in instrumentation lines, the frequent cause of processing shut-downs, are avoided with the installation of Swagelok fittings. They form a leakproof seal with one and one quarter turns. No torque is transmitted to the tubing in assembly. Swagelok fittings are made in all popular sizes and will hold heavy or thin wall tubing equally well.

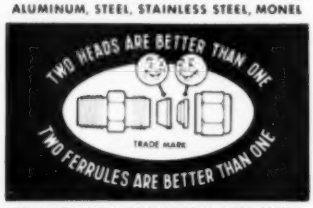
FREE—For complete details and descriptive literature write Dept. AP

* Patented

CRAWFORD FITTING CO.

884 E. 140th Street, Cleveland 10, Ohio

SWAGELOK FITTINGS AVAILABLE IN: BRASS, ALUMINUM, STEEL, STAINLESS STEEL, MONEL



COME TO YOU COMPLETELY ASSEMBLED, FINGER TIGHT

Processing Patents

drying oils by selective hydrogenation.

U.S. 2,559,152 (Sun Oil Co.) Isotope concentration process.

U.S. 2,559,153 (Shell Development Co.) Separation of sterols from mixtures.

U.S. 2,559,162 (Sun Oil Co.) Thiourea-aldehyde sealing agents.

U.S. 2,559,324-5 (Spillane) Converting sulfur-containing materials to sulfur, etc.

U.S. 2,559,347 (Shell Development Co.) Drying compositions resistant to gas checking and frosting.

U.S. 2,559,496 (Standard Oil Development Co.) Sulfuric acid regeneration.

U.S. 2,559,498 (Standard Oil Development Co.) Resins from diisobutylene and cracked petroleum condensate.

U.S. 2,559,503 (Standard Oil Development Co.) Nitrogenous derivatives of petroleum sulfonic acids.

U.S. 2,559,567 (Socony-Vacuum Oil Co.) Simple tertiary thenylamines.

U.S. 2,559,569 (Ethyl Corp.) Benzene hexachloride.

U.S. 2,559,585 (Beck et al) Preparation of sulfonic acid compounds.

U.S. 2,559,818 (Phillips Petroleum Co.) Process for production of alkyl benzenes.

U.S. 2,559,947 (Phillips Petroleum Co.) 1,2-Diolefins as modifiers in the alkali-metal-catalyzed polymerization of conjugated diolefins.

U.S. 2,559,985 (Phillips Petroleum Co.) Process for air-blowing clay tower polymer.

U.S. 2,560,027 (Firestone Tire & Rubber Co.) Continuous polymerization of butadiene and styrene.

U.S. 2,560,629 (Firestone Tire & Rubber Co.) Butadiene-styrene rubbery copolymer stabilized with antimonyl-4,6 dimethyl catecholate.

U.S. 2,560,631 (Firestone Tire & Rubber Co.) Rubbery mixture of butadiene-styrene copolymer and polybutadiene.

U.S. 2,560,164 (Standard Oil Development Co.) Friedelcrafts treatment of unsaturated polymers.

U.S. 2,560,173 (Standard Oil Co.—Indiana) Condensation of alkyl aryl ethers with alpha-halogen alkanals.

U.S. 2,560,339 (Standard Oil Development Co.) Hydrocarbon plasticizers for oil-resistant polymers.

U.S. 2,560,355 (Standard Oil Development Co.) Condensation products of silicon halides with chlorwax-naphthalene and chlorwax-phenol.

U.S. 2,560,361 (Standard Oil Development Co.) Production of 3,3,5-trimethyl cyclohexanone.

U.S. 2,560,371 (Standard Oil Development Co.) Sulfur-halogen compound.

U.S. 2,560,373 (Standard Oil Development Co.) Recovery and purification of durene.

U.S. 2,560,421 (Standard Oil Development Co.) Halogenated tertiary alkyl sulfides and polysulfides.

U.S. 2,560,492 (Standard Oil Development Co.) Copolymers of substituted styrenes and polyolefins.

U.S. 2,560,555 (California Research Corp.) Reduction of organic nitro compounds to amines.

U.S. 2,560,610 (Phillips Petroleum Co.) Production of alkenyl-thiophenes.

U.S. 2,560,666 (Gulf Research & Development Co.) Process for producing 4-tertiary-butyl-3-methylphenol.

U.S. 2,560,931 (Socony-Vacuum Oil Co., Inc.) Dehydration of acetonitrile.

U.S. 2,561,226 (Standard Oil Development Co.) Method of polymerizing olefins at subatmospheric temperatures.

U.S. 2,561,232 (Standard Oil Development Co.) Dialkylalkenylsuccinates.

U.S. 2,561,239 (Standard Oil Development Co.) Plasticized rubbery copolymer of isobutylene and isoprene.

U.S. 2,561,254 (Shell Development Co.) Unsaturated ether aldehydes and acetals thereof.

U.S. 2,561,256 (Standard Oil Development Co.) Method of drying synthetic rubber polymers.

U.S. 2,561,313 (Monsanto Chemical Co.) Unsaturated oil-soluble copolymers.

U.S. 2,561,613 (Shell Development Co.) Condensation products of unsaturated ether-aldehydes, polymers thereof, and methods for producing the same.

U.S. 2,561,673 (Standard Oil Co.) Conversion of disulfides to thia-succinic acids.

U.S. 2,561,690 (Cities Service Oil Co.) Purification of methanol by azeotropic distillation.

U.S. 2,561,729 (Standard Oil Development Co.) Polymerization of isoolefins with complex Friedel-Crafts metal halide catalysts.

U.S. 2,561,787 (Socony-Vacuum Oil Co.) Production of nitriles.

U.S. 2,561,796 (Standard Oil Development Co.) Olefinhaloaromatic copolymer and preparation thereof.

U.S. 2,561,984 (Phillips Petroleum Co.) Production of primary alcohols and aldehydes.

U.S. 2,561,996 (Phillips Petroleum Co.) Acetylene generation from hydrocarbons.

U.S. 2,562,090 (Phillips Petroleum Co.) Polymerization of dibromobutene.

U.S. 2,562,145 (Shell Development Co.) Preparation of saturated sulfur-containing heterocyclic compounds.

Hydrocarbon Synthesis

U.S. 2,558,746 (The Texas Co.) Carbon monoxide and other gases from carbonaceous materials.

U.S. 2,558,760 (Hydrocarbon Research, Inc.) Hydrocarbon synthesis.

U.S. 2,560,171 (M. W. Kellogg Co.) Synthesis of organic compounds from CO-H_2.

U.S. 2,560,325 (Standard Oil Development Co.) Hydrocarbon synthe is.

U.S. 2,560,344 (Standard Oil Development Co.) Two stage hydrocarbon synthes.s operation.

U.S. 2,560,345 (Standard Oil Development Co.) Pretreatment of catalyst for hydrocarbon synthesis.

U.S. 2,560,380 (Standard Oil Development Co.) Synthesis of oxygenated organic compounds.

U.S. 2,560,403 (Standard Oil Co.—Indiana) Method for processing carbonaceous solids to produce CO and H_2.

U.S. 2,560,469 (Standard Oil Development Co.) Oxygen process.

U.S. 2,561,244 (Standard Oil Development Co.) Hydrogenation of oxides of carbon to produce high boiling alcohols and liquid hydrocarbons.

Conversions

U.S. 2,558,769 (Houdry Process Corp.) Control of hydrocarbon reactions in moving solids contacting systems.

U.S. 2,558,838 (Phillips Petroleum Co.) Treating catalytic gas oil by extraction and alkylation of aromatics.

U.S. 2,559,062 (Standard Oil Development Co.) Friedel-Crafts metal halide-ether complexes as polymerization catalysts.

U.S. 2,559,285 (Phillips Petroleum Co.) Catalytic cracking and destructive hydrogenation of heavy asphaltic oils.

U.S. 2,559,576 (Universal Oil Products Co.) Polymerization with tetraborohypophosphoric acid catalyst.

U.S. 2,559,646 (Houdry Process Corp.) Conversion apparatus for controlling distribution of gases passing therethrough.

U.S. 2,559,876 (Universal Oil Products Co.) Device for controlling the level of subdivided solid particles within a contacting chamber.

U.S. 2,560,329 (Standard Oil Development Co.) Catalytic dehydrogenation of petroleum naphthenes.

U.S. 2,560,340 (Standard Oil Development Co.) Polymerization process.

U.S. 2,560,343 (Standard Oil Development Co.) Catalytic conversion process.

U.S. 2,560,356 (Shell Development Co.) Fluidized powder flow and control.

U.S. 2,560,511 (Anglo-Iranian Oil Co., Ltd.) Catalytic cracking of heavy hydrocarbons in two stages.

U.S. 2,560,604 (Houdry Process Corp.) Manipulation of fluent solids.

U.S. 2,560,809 (Sinclair Refining Co.) Process and apparatus for the catalytic conversion of hydrocarbons.

U.S. 2,561,334 (The Lummus Co.) Method of hydrocarbon conversion to lower boiling hydrocarbons and coke.

U.S. 2,561,409 (Houdry Process Corp.) Processes employing fluent solids.

U.S. 2,561,429 (The Lummus Co.) Continuous hydrocarbon conversion process and apparatus.

U.S. 2,561,771 (Houdry Process Corp.) Processes employing fluent solids.

U.S. 2,561,852 (Filtrol Corp.) Process and apparatus for catalytic reactions and adsorptions.

Refining

U.S. 2,558,809 (Phillips Petroleum Co.) Fractionation of reduced crude.

U.S. 2,558,863 (Svenska-Skifferolje Akt.) Refining petrol to remove carbon bisulfide and mercaptans.

U.S. 2,559,129 (The Girdler Corp.) Removing gaseous and readily vaporizable material from liquids.

U.S. 2,559,157 (Sun Oil Co.) Separation of iso-paraffins by activated carbon.

U.S. 2,559,457 (Gulf Research & Development Co.) Hydrodesulfurization of petroleum hydrocarbons.

U.S. 2,559,580 (The Girdler Corp.) Stabilization of aqueous amine solutions against oxidation and corrosion in gas separation processes.

U.S. 2,559,957 (Phillips Petroleum Co.) Pebble heater.

Processing Patents

U.S. 2,560,070 (The Lummus Co.) Evaporator.
U.S. 2,560,071 (Centrifix Corp.) Fixed centrifugal device.
U.S. 2,560,072 (Centrifix Corp.) Apparatus for fractionation.
U.S. 2,560,075 (The Lummus Co.) Evaporator.
U.S. 2,560,077 (Centrifix Corp.) Apparatus for contacting gases and liquids to effect concentration, fractionation, etc.
U.S. 2,560,178 (Standard Oil Co.—Indiana) Regenerating mercaptan solvent (KOH-methanol).
U.S. 2,560,193 (Standard Oil Co.—Ind.) Dehaving hydrocarbon oils with urea.
U.S. 2,560,330 (Standard Oil Development Co.) Method of refining kerosene with bauxite and sulfur dioxide.
U.S. 2,560,333 (Petrolite Corp., Ltd.) Process for breaking petroleum emulsions.
U.S. 2,560,362 (Standard Oil Development Co.) Acid extraction of mixed olefin hydrocarbons.
U.S. 2,560,374 (Standard Oil Development Co.) Treatment of sour petroleum distillates with alkanolamine and oxidation.
U.S. 2,560,415 (Gulf Oil Corp.) Hydrodesulfurization by contact absorption.
U.S. 2,560,433 (Gulf Research & Development Co.) Desulfurization of hydrocarbon oils with iron catalyst in essence of hydrogen.
U.S. 2,560,544 (Standard Oil Co.—Ohio) Method of processing lubricating oil by treating with sulfuric acid, a phosphorus sulfide and clay.
U.S. 2,560,545 (Standard Oil Co.—Ohio) Method of processing lubricating oil by solvent-extraction and treating with a phosphorus sulfide and clay.
U.S. 2,560,546 (Standard Oil Co.—Ohio) Method of processing solvent-extracted lubricating oil by treating with phosphorus pentasulfide and a base.
U.S. 2,560,547 (Standard Oil Co.—Ohio) Method of processing lubricating oil by treating with sulfuric acid, a phosphorus sulfide and a base.
U.S. 2,560,548 (Standard Oil Co.—Ohio) Method of processing solvent-extracted lubricating oil by treating with a phosphorus sulfide, a base and clay.
U.S. 2,560,632 (Leonard Refineries, Inc.) Stabilizing cracked distillate with formaldehyde.
U.S. 2,560,633 (Leonard Refineries, Inc.) Method of stabilizing catalytically cracked furnace distillates with formaldehyde and amine.
U.S. 2,560,645 (Phillips Petroleum Co.) Method of separating high condensation point materials from hydrocarbons.
U.S. 2,560,767 (Universal Oil Products Co.) Distillation of carbonaceous solids.
U.S. 2,560,935 (M. W. Kellogg Co.) Extraction of oleiferous materials.
U.S. 2,561,596 (Phillips Petroleum Co.) Liquefied gas evaporation.
U.S. 2,561,530 (Gulf Research & Development Co.) Low-pressure hydrogenation process.
U.S. 2,561,624 (Gulf Research & Development Co.) Separation of cyclohexane and benzene by azeotropic distillation.
U.S. 2,561,720 (Phillips Petroleum Co.) Method and apparatus for removing condensibles from gases.
U.S. 2,561,822 (The Pure Oil Co.) Concentration of olefins.
U.S. 2,561,990 (Jefferson Lake Sulphur Co.) Sulfur recovery from spent catalysts.
U.S. 2,562,068 (Shell Development Co.) Separation of xylene isomers by solvent extraction.

Fuels

U.S. 2,559,071 (Borg-Warner Corp.) Propellant of 80-90% tetranitromethane, less than 1% of triphenyl bismuthine, tetraphenyl tin or tetraethyl lead as inhibitor to control rate of combustion and balance of an unsaturated organic liquid fuel.
U.S. 2,559,605 (U.S.A.) Ammonia fuel mixture for internal-combustion engines.
U.S. 2,560,152 (Berl, et al) Storage of liquid fuels in adsorbent.
U.S. 2,560,213 (Wright Aeronautical Corp.) Antidetonant injection system.
U.S. 2,560,262 (Wright Aeronautical Corp.) Automatic antidetonation system.
U.S. 2,560,357 (Standard Oil Development Co.) Production of solid fuel agglomerates.
U.S. 2,560,368 (Shell Development Co.) Inhibition of ice formation in fuels.
U.S. 2,560,478 (Standard Oil Development Co.) Process for mild oxidation of carbonaceous solids (coal).
U.S. 2,560,489 (Gulf Oil Co.) Stabilized leaded gasolines.
U.S. 2,560,602 (Phillips Petroleum Co.) Fuel composition containing picolene and C_{5-9} branched chain hydrocarbons.
U.S. 2,560,898 (Phillips Petroleum Co.) Fuel composition containing pyridine and isoparaffins.
U.S. 2,560,904 (Ethyl Corp.) Diesel fuel con-

"MUST" reading

for the man in charge of tube maintenance and repair

Before you purchase tube maintenance equipment, read what AIRETOOL has to say:

Tube Expanding Control—Tube rolling time is cut in half with this new accurate tube rolling control.

BULLETIN 47

The Refinery Catalog—Your buying guide for proper cleaning, expanding and maintaining refinery tubes.

BULLETIN 48

Ball-Bearing Motors—Facts about why Airetool's new powerful motors last longer and do a better job.

BULLETIN 49

Condenser Cleaners—Specially designed cleaners for condenser and heat exchanger tubes.

BULLETIN 40

AIRETOOL is the FIRST NAME in refinery tube cleaners, expanders and tube maintenance equipment. To get your copies of the colorful bulletins shown above, write The AIRETOOL Mfg. Co., 336 S. Center St., Springfield, Ohio.

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

There's an AIRETOOL Tube Cleaner and Tube Expander for Every Type of Tubular Construction

BRANCH OFFICES: New York, Philadelphia, Chicago, Tulsa, Baton Rouge, Houston

(To obtain more data on advertised products see page 1028)

taining dinitrocycloalkane.
U.S. 2,561,419 (The Lummus Co.) Process for producing gas from oil.

Specialties

U.S. 2,559,260 (Socony-Vacuum Oil Co.) Imparting water repellency to fibrous materials.
U.S. 2,559,398 (Gulf Research & Development Co.) Wax composition containing bentonite compound.
U.S. 2,559,439 (Shell Development Co.) Recovering oil soluble sulfonates.
U.S. 2,559,645 (Shell Development Co.) Method of blending polyethylene-amorphous petroleum wax compositions.
U.S. 2,560,148 (Shell Development Co.) Wax emulsion.
U.S. 2,560,202 (Standard Oil Development Co.) Rust inhibiting composition containing pentaerythritol oleate.
U.S. 2,560,626 (Shell Development Co.) Insecticidal and fungicidal spray oil.
U.S. 2,560,642 (C. D. Patents Limited) Treatment of pitches or tars and the manufacture of molded articles therefrom.
U.S. 2,560,650 (Kronstein) Process for modifying, solidifying, and insolubilizing asphalts with peroxides.
U.S. 2,561,209 (Standard Oil Development Co.) Hydrogenated dicyclopentadiene insecticide.
U.S. 2,561,251 (National Chemical Products, Ltd.) Trialkoxy paraffins as froth flotation frothing agents.
U.S. 2,561,791 (California Research Corp.) Aliphatic unsaturated branched-chain siccatives.
U.S. 2,561,816 (Socony-Vacuum Oil Co.) Polish.
U.S. 2,562,149 (Moliring) Asphalt pelletizer.
U.S. 2,559,510 (Standard Oil Development Co.) Synthetic lubricants from dicarboxylic acid esters.
U.S. 2,559,521 (Standard Oil Development Co.) Synthetic lubricant.
U.S. 2,559,984 (Gulf Research & Development Co.) Process of preparing polymeric lubricating oils.
U.S. 2,560,051 (Firestone Tire & Rubber Co.) Thixotropic friction material lubricant.
U.S. 2,560,418 (Standard Oil Development Co.) Recovery of lubricating oil from solvent extracts, using silica gel.
U.S. 2,560,479 (Gulf Research & Development Co.) Production of lubricating oils by extraction and sulfonation.
U.S. 2,560,542 (Standard Oil Co.—Ohio) Clean-burning carbonaceous lubricating compositions.
U.S. 2,560,543 (Standard Oil Co.) Method of processing lubricating oil by treating with a phosphorus sulfide.
U.S. 2,560,588 (Standard Oil Development Co.) Mineral oil containing pour inhibiting polymers of esters of fumaric acid.
U.S. 2,560,956 (Socony-Vacuum Oil Co., Inc.) Mineral oil compositions containing V.I. improving polymers of thiophene.
U.S. 2,560,986 (Socony-Vacuum Oil Co., Inc.) Mineral oil compositions containing detergent petroleum wax carboxylic acids.
U.S. 2,561,573 (Socony-Vacuum Oil Co., Inc.) Lubricating oil compositions containing the reaction products of diesters of dithiophosphoric acid and pinene.
U.S. 2,561,780 (Socony-Vacuum Oil Co., Inc.) Mineral oil compositions containing thienylthioalcohols.
U.S. 2,562,144 (Shell Development Co.) Lubricating composition containing sulfurized polyether.

Catalysts

U.S. 2,559,653 (Kaiser Aluminum & Chemical Corp.) Recovery of alumina from alumina-containing ores.
U.S. 2,560,707 (E. I. duPont de Nemours & Co.) Alumina sols.
U.S. 2,561,331 (Houdry Process Corp.) Catalyst regeneration.
U.S. 2,561,396 (Standard Oil Development Co.) Segregation of solid particles.
U.S. 2,561,408 (Houdry Process Corp.) Catalyst regeneration.
U.S. 2,561,422 (Houdry Process Corp.) Process of extracting iron from clay.

Miscellaneous

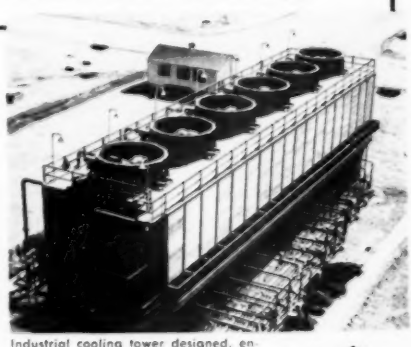
U.S. 2,559,069 (Standard Oil Co.—Ind.) Choke for abrasive fluids.
U.S. 2,559,173 (Sun Oil Co.) Synchronous rectifier.
U.S. 2,559,219 (Texaco Development Corp.) Detection and measurement of penetrative radiation.
U.S. 2,559,516 (Standard Oil Development Co.) Apparatus for combining two or more fluids.
U.S. 2,559,518 (Standard Oil Development Co.) Recirculating tank mixing system.
U.S. 2,559,574 (Weissberg) Dispensing petroleum sludge.
U.S. 2,559,729 (Universal Oilgas Heating A/S) Regenerative gas combustion furnace for liquid fuels.
U.S. 2,559,814 (Power Jets (Research & Development) Ltd.) Cooling combustion-engine air supply by ammonia.
U.S. 2,560,069 (The Lummus Co.) Mixer.
U.S. 2,560,074 (The Lummus Co.) Method and apparatus for burning fuel.
U.S. 2,560,076 (The Lummus Co.) Method and apparatus for burning fuel.
U.S. 2,560,078 (The Lummus Co.) Combustion apparatus and method.
U.S. 2,560,366 (Standard Oil Development Co.) Clamping device for force responsive elements.
U.S. 2,560,455 (Phillips Petroleum Co.) Thermocouple return bend and well.
U.S. 2,560,559 (U.S.A.) Gasoline operated pneumatic tool.
U.S. 2,560,795 (Dale E. Harris) Heater for lubricants.
U.S. 2,561,242 (Standard Oil Development Co.) Portable freight elevator.
U.S. 2,561,330 (Phillips Petroleum Co.)—Process for refining soybean oil.
U.S. 2,562,148 (Phillips Petroleum Co.) Low water-loss cement slurry.

How to Obtain Patents

Readers may obtain copies of any U. S. patent from the Patent Office at 25 cents each. Order by patent number direct from the Commissioner of Patents, Washington 25, D. C.

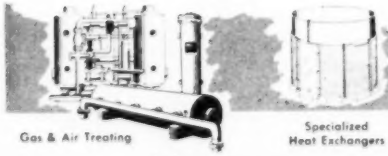
It's a Pritchard Quality Tower...It's Getting the Job Done More Efficiently...More Economically!

You can always depend on Pritchard Quality Cooling Towers to do the job more efficiently . . . and at greater savings. Pritchard Towers are guaranteed to meet your peak loads as well as normal requirements because they're *adequately* sized and *thoroughly* engineered. Manufactured of highest quality materials for longer life, Pritchard Cooling Towers give you trouble-free service that cuts maintenance and repair costs. You save more water, too . . . up to 99% over former wasteful methods. Let Pritchard skill and experience go to work for you on your next cooling tower job!



Industrial cooling tower designed, engineered and constructed by J. F. Pritchard & Co.

Write for Bulletins



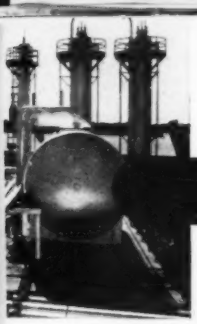
Products of QUALITY Specialized Process EQUIPMENT

J.F. Pritchard & Co.

EQUIPMENT DIVISION

Dept. No. 185 — 908 Grand Ave., Kansas City 6, Mo.

District Offices: CHICAGO • HOUSTON • NEW YORK • PITTSBURGH
TULSA • ST. LOUIS • Representatives in Principal Cities from Coast to Coast



EQUIPMENT PATENTS

Brief Reviews of New Inventions in Equipment

"Bubbler" Liquid Level Gage

Precise metering of oil tank depths is provided in air line static fluid pressure indicator

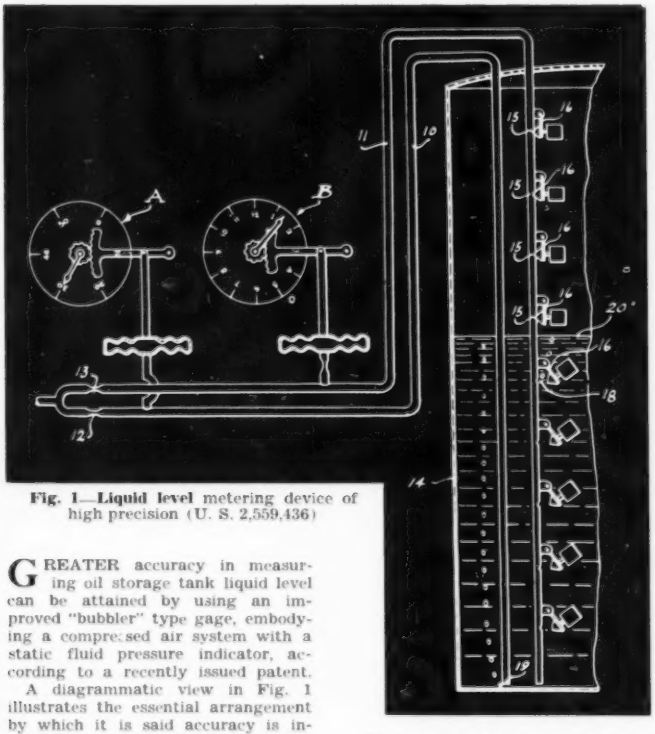


Fig. 1—Liquid level metering device of high precision (U. S. 2,559,436)

GREATER accuracy in measuring oil storage tank liquid level can be attained by using an improved "bubbler" type gage, embodying a compressed air system with a static fluid pressure indicator, according to a recently issued patent.

A diagrammatic view in Fig. 1 illustrates the essential arrangement by which it is said accuracy is increased 10 times over previous types of air line depth gages. As shown, two lines 10 and 11 are connected through restrictions 12 and 13 to a single source of compressed air. Line 10 extends down into the tank and ends at a fixed point near the bottom. Line 11 also extends down into the tank, ending at the same level as line 10.

At uniformly spaced intervals along line 11 are a series of openings 15 which normally are closed by valves 16 when the opening is above the surface of the liquid. When the openings are below the surface, the float operated valves open.

Connected to lines 10 and 11 are conventional types of diaphragm operated pressure gages A and B. When air passes slowly through the two lines, tank fluid is forced out of line 10 until bubbles begin to be emitted from the end 19 of line 10. Since the flow rate is small, substantially the same pressure will obtain throughout the entire length of line 10. This pressure may be read on gage A, which may be suitably calibrated in feet or gallons, if the specific gravity of the fluid is known.

Experiments have shown that the accuracy will be about 0.05% of total depth being measured. Where the tank height is great, this error might be rather large, but by means of gage B, it is sufficient to obtain a reading on gage A which is merely correct enough to indicate a depth in gross units.

By virtue of the fact that all valves 16 below liquid level 20 are open, air from line 11 will escape from opening 18 with the level 20 in the position shown, and fluid will fill air line 11 up to the opening 18. Thus, the pressure registered on gage B will be merely the depth of hole 18 below surface 20, and will be always less than the distance between two adjacent holes 15. Again the probable error is about 0.05% of total depth being measured, which in this case instead of total fluid depth will be something less than 0.05% of distance between consecutive openings 15.

Thus, if gage B is calibrated in inches and the distance between consecutive openings is 12 in., it is possible at any given time to read off an accurate depth of the tank to within 0.05% of one foot, taking the reading in feet from gage A and the reading in inches from gage B.

Capillary restrictions 12 and 13 make it possible to feed both air lines from the same source without having any feed back from line 10, which has higher pressure than line 11.

U. S. 2,559,436, issued July 3, 1951, to Siegfried Gordon Iserstedt, assignor to Corex Ltd., Toronto, Ont.

Better Header Box For Process Furnaces

A REVISED design for the upper header box on a vertical, cylindrical process furnace is claimed to overcome the disadvantages of the more conventional design which uses flat header boxes in which structural steel members carry the bending moments of the stack.

The usual header box was horizontal, rectangular in cross section, and covered with flat plates or doors with the structural supporting members inside the box. If there was a leak in the furnace headers resulting in a fire, the structural members were likely to fail due to the intense heat within the restricted space. Also, it was very difficult to make the header box waterproof because the horizontal plates did not readily shed water flowing down from the stack.

In the recently patented invention, the flat box and its internal members

Pacific

CENTRIFUGAL PROCESS PUMPS

solves your extraordinary corrosive pumping problems

extra **CORROSION ALLOWANCE** . . . All Pacific Process Pumps are custom-built with the case casting thickness in excess of the actual pressure-temperature requirements. This provides a liberal allowance for corrosion-erosion and a high safety factor.

extra **HEAVY CONSTRUCTION** . . . Pumps are developed to combine the strength necessary for continuous heavy duty service with the simplicity and accessibility for low maintenance cost. All parts in contact with pumped liquid may be fabricated from any commercially available ferrous or non-ferrous metal.

extra **CAPACITY** . . . Types SVC and SEC single-stage Process Pumps handle liquids from sub-zero to 800°F.; 15 to 1600 gpm; 500 to 600 psig pressure; heads up to 600 feet; speeds to 4,000 rpm. Type RVC two-stage Process pumps handle liquids from sub-zero to 850°F.; to 600 psig pressure; heads to 825 feet; speeds to 3,600 rpm. All 3 types available with suction diameter from 1½" to 8"; discharge diameters from 1" to 6".

Write for Bulletins 101 and 108

Pacific Pumps inc.
ONE OF THE DRESSER INDUSTRIES

PACIFIC Precision Built PUMPS

HUNTINGTON PARK, CALIFORNIA
Export Office: Chanin Bldg., 122 E. 42nd St., New York
Offices in All Principal Cities

CP-3

are replaced with an arrangement comprising a truncated, conical, structural steel framework having header box plates in the form of segments bolted to the insides of the steel framework. Thus, the structural members are all external to the header box compartments, and the conical plates form a construction bolted to those same members, and readily made waterproof. In addition, the arrangement provides a convenient trough-like receptacle around the header box to accommodate spare fittings, operators' tools, and the like.

U. S. 2,555,552, issued June 5, 1951, to John Litell and John S. Wallis, assignors to Petro-Chem Process Co., Inc., New York.

Patents Issued in July

The following classified listing covers patents issued during the month of July believed to be of interest or value to petroleum processing or handling operations:

Catalytic Reactors

2,559,616 (Houdry Process Corp.)—Catalytic conversion apparatus of fixed bed type and associated arrangement for controlling the distribution of gases passing through it.
2,560,899 (Sinclair Refining Co.)—Apparatus and process of the fluid type for the catalytic conversion of hydrocarbons.
2,561,852 (Filtrol Corp.) — Apparatus and process of the fluid type for catalytic reactions and adsorptions.

Processing, general

2,558,752 (Air Preheater Corp.)—Regenerative heat exchanger.
2,558,861 (Universal Oil Products Co.)—Apparatus for production of acetylene and other hydrocarbons.
2,559,066 (Ray M. Potter)—Electrochemical proportioning apparatus, for water treating and also mixing electrically conductive fluids.
2,559,129 (Girdler Corp.) — Apparatus and method for removing gaseous and readily vaporizable materials from liquids.
2,559,256 (Arrow Industrial Mfg. Co.)—Tie bar for heat exchanger headers.
2,559,516 (Standard Oil Development Co.)—Apparatus and method for combining fluids, using the "micro-mixing" technique.
2,559,518 (Standard Oil Development Co.)—Recirculating tank mixing system.
2,559,957 (Phillips Petroleum Co.) — Pebble heater.
2,560,071, 2,560,072, and 2,560,077 (Centrifix Corp.)—Fixed centrifugal device for contacting gases and liquids in concentration, fractionation, and the like.
2,560,356 (Shell Development Co.)—Fluidized powder flow and control, useful in catalytic conversions, oxidation reactions, retorting shale oil, etc.
2,561,420 (The Lummus Co.)Continuous hydrocarbon conversion process and apparatus of the thermal type for coking.
2,561,506 (Phillips Petroleum Co.)—Liquefied gas evaporator.
2,561,720 (Phillips Petroleum Co.)—Apparatus and method for removing condensables from gases.
2,562,545 (Ultrasonic Corp.)—Apparatus for agitating materials with compression waves.
2,562,735 (The Permutit Co.)—Liquid treating apparatus.
2,562,783 (Standard Oil Development Co.)—Counter-current extraction tower.

Instruments

2,558,743 (Qualitrol Corp.)—Thermometer in which primary element is bi-metallic, helical coil.
2,559,383 (Minneapolis - Honeywell Regulator Co.)—Multiple recording instrument.
2,559,436 (Corex Ltd., Toronto, Ont.)—Apparatus for measuring liquid contents of large oil storage tanks.
2,559,849 (Universal Oil Products Co.)—Elec-

tronic speed indicator, for use in controlling mixing speed of so-called induction stirrers.
2,559,856 (Universal Oil Products Co.)—Device for controlling the level of subdivided solid particles within a contacting chamber.
2,559,900 (Atlantic Refining Co.)—Meter for determining the amount of catalyst fines in flue gas from a catalytic cracking unit regenerator.
2,560,434 (Minneapolis-Honeywell Regulator Co.)—Internal combustion engine knock meter which detects fluctuations in ionization.
2,560,948 (Shell Development Co.)—Differential pressure metering system.
2,561,204 (American Machine and Metals, Inc.)—Pressure gauge.
2,561,414 (Tennessee Valley Authority)—Gas analyzer.
2,561,662 (Socony-Vacuum Oil Co., Inc.)—Consecutive-reading oil storage tank gaging device.
2,561,700 (Infilco, Inc.)—Differential pressure gauge.
2,562,181 (J. C. Frommer)—Apparatus for detecting cloudiness in transparent material.
2,562,256 (M. R. Wall)—Temperature and pressure responsive switch.
2,562,494 (Meriam Instrument Co.)—Pressure measuring apparatus.
2,562,525 (Beckman Instruments, Inc.)—Infrared spectrophotometer.
2,562,854 (Applied Research Corp.)—Apparatus for spectrophotometric quantitative analysis.

Pumps & Compressors

2,559,590 (Arthur E. Brown)—Rotary fluid mechanism.
2,559,980 (Clyde M. McAllister)—Reciprocating plunger type pump for chemical injection under pressure.
2,560,646 (Eastman Kodak Co.)—Jet type oil vapor vacuum pump.
2,561,048 and 2,561,809 (Megator Pumps & Compressors Ltd., Feltham, England)—Pump, compressor, motor, or the like.
2,561,810 (Megator Pumps & Compressors Ltd., Feltham, England)—Positive displacement pump.

Valves & Fittings

2,558,962 (Dole Valve Co.)—Thermostatically controlled fluid mixing valve.
2,559,695 (Cameron Iron Works, Inc.)—Plug type valve and seal, for high pressure service.
2,560,455 (Phillips Petroleum Co.)—Thermocouple return bend and well.
2,561,028 (Jim E. Looney)—Plug valve for high pressure petroleum fluids.
2,561,214 (General Electric Co.)—Combination balanced shutoff and throttling valve assembly.
2,561,246 (John Thomson, Edinburgh, Scotland)—Steam trap.
2,561,431 (Electraulic Presses Ltd., Rodley, near Leeds, England)—Automatic hydraulically operated control valve.
2,561,618 (Western Products, Inc.)—Actuator for safety valve.
2,562,003 (Mueller Co.) — Lubricated plug valve.
2,562,255 (New Products Corp.) — Rotary valve.
2,562,285 (G. Dikkers & Co., N. V., Hengelo, Netherlands)—Gate valve.
2,562,289 (Minneapolis-Honeywell Regulator Co.)—Safety gas valve.
2,562,315 (Dole Valve Co.)—Diaphragm valve.
2,562,672 (Black, Sivalls & Bryson, Inc.)—Combination pressure relief and safety head valve.

Furnaces & Boilers

2,560,063 (Combustion Engineering-Superheater, Inc.)—Support for elements of superheaters and other heat exchangers.
2,560,070 (The Lummus Co.)—Steam evaporator.
2,560,078 (The Lummus Co.)—Combustion apparatus and method for vertical fuel burning.
2,560,888 (John S. Zink)—Gas burner with air and flame baffles.
2,561,194 and 2,561,200 (Selas Corp. of America)—Internal gas burner.
2,561,793 (Selas Corp. of America)—Incandescent gas burner for furnace wall.
2,561,795 (Selas Corp. of America)—Gas and oil burner.
2,562,072 (Petro-Chem Process Co., Inc.)—Segmental tube sheet for vertical, cylindrical process furnaces.

Packing, Seals, Gaskets

2,559,963 and 2,559,964 (Rotary Seal Co.)—Bearing seals.
2,560,660 (Sinclair Refining Co.)—Nonleaking rotary seal.
2,561,132 (Crane Packing Co.)—Rotary seal with O ring.
2,561,694 (Syntron Co.)—Rotary seal.

Tools

2,559,973 (Bernard P. Kunz)—Pivoted jaw wrench.
2,559,974 (Bernard P. Kunz)—Wrench with a pivoted outer jaw.
2,560,758 (Martin C. Patterson, Jr.)—Pipe cutting machine.
2,561,484 (A. W. Shaw, R. J. Bullard, and F. L. Claire)—Power-operated pipe-cutting tool.

Fire Extinguishers

2,559,634 (International Chemical Extinguisher Corp.)—Dry powder fire-extinguisher apparatus.
2,560,407 (Randolph Laboratories, Inc.)—Fire extinguisher of the inert gas type.
2,560,468 (Charles R. Morton)—Automatic fire extinguisher actuator.

Tanks & Vessels

2,559,137 (N. V. Hollandsche Constructie Werkplaatsen, Leiden, South Holland, Netherlands)—Dry gasholder with a ballast actuated piston.
2,560,556 (Chicago Bridge & Iron Co.)—Floating roof drain.
2,562,601 (L. J. Dubois, Paris, France)—Storage tank for liquids or gases.

Miscellaneous

2,558,983 (Frank B. Roberts)—Barrel cleaning mechanism.
2,561,728 (Phillips Petroleum Co.)—Pulsation dampening chamber.

NOW... More Than Ever...
PROTECT YOUR TANKS!

Shortages of steel, for new tankage and repair of old, necessitates your making every tank last as long as possible.

NATASCO protective coatings prevent corrosion damage of new tanks and provide many additional years of service from old ones.

Trained application crews provide a complete protection service including preparation of the surfaces, priming and application, assures maximum results. Your request for full particulars will receive prompt attention. Telephone, wire or write.

CONTRACT SERVICES:
- Tank Welding Repairs and Maintenance
- Installation of Tank Appurtenances
- Tank Painting
- Application of Protective Coatings
- Tank Cleaning — BS&W Emulsion Chemical Treating

Manufacturers of Liquid Level Tank Gauges

THE Natasco COMPANY
PROTECTS TANKS AGAINST CORROSION
P. O. BOX 1318 TULSA, OKLAHOMA

Lease Tank Service—West Texas Area:
Williams Construction Co.
Odessa, Texas

California Representative:
Pacific Coast Contractors, Inc.
2627 Atlantic Ave., Long Beach 6, Calif.

(To obtain more data on advertised products see page 1028)

ENJAY

*Trade-Mark

A pointer for products

sells an extensive line of oxygenated solvents and chemicals

Every day more industries are buying Enjay chemicals. Industrial users know that the solvents and chemicals sold under the ENJAY* Oval Trade-mark are famous for high-quality and dependability.

EXPERIENCED

RELIABLE

DIVERSIFIED

ENJAY markets this wide range of industrial chemicals:

Petrohol 91 (Isopropyl Alcohol)	Methyl Ethyl Ketone	Aromatic Tars
Petrohol 95 (Isopropyl Alcohol)	Ethyl Ether	Paratone
Petrohol 99 (Isopropyl Alcohol)	Isopropyl Ether	Parapoid
Secondary Butyl Alcohol	Diisobutylene	Paratac
Isooctyl Alcohol	Polypropylenes	Paranox
Isopropyl Acetate	Butadiene	Paraflow
Secondary Butyl Acetate	Isoprene	Vistanex
Acetone	Dicyclopentadiene	Naphthenic Acids

ENJAY products are marketed in bulk or in quantities to fit your requirements.

ENJAY COMPANY, INC.
15 W. 51st St., New York 19, N. Y.

NEWS OF SUPPLIERS

Manufacturers
Distributors
Engineering Firms

Clark Opens New Pittsburgh Office

Clark Bros. Co., Inc. have established a new sales and service office in Pittsburgh, located at 2920 Koppers Bldg. The territory covered by this new office was formerly served by William H. Bendean, directly from the factory and main offices in Olean, N. Y.

Mr. Bendean

Mr. Hanley

District manager and in charge at Pittsburgh will be Sidney S. Hanley, who has been working with Mr. Bendean out of Olean for the past five years. Prior to his field experience, Mr. Hanley was in technical sales on specialized projects in compressors, both reciprocating and centrifugal.

Although Mr. Bendean will be taking it a bit easier than he has for the past 36 years, he will continue as a consultant out of the home office for Clark. Two other staff members in the new Pittsburgh office, working with Mr. Hanley, are James D. Gilbride and Robert T. Nelson.

Blaw-Knox Builds Oxygen Plant

Chemical Plants Division of Blaw-Knox Co., Pittsburgh, is handling an order for Houston Oxygen Co. for an 18 ton / day, 99.7% purity oxygen plant, to be located in Houston. The equipment will be furnished by Blaw-Knox's German associates, Gesellschaft fuer Linde's Eismaschinen, Hoellriegelskreuth, Germany.

The plant, which will be a complete air separation unit, will also produce 10,000 cu. ft./day of argon of 99.9% purity, and some high purity nitrogen.

Indiana Catalyst Plant Now Operating

American Cyanamid Co.'s new $3,000,000 plant in Michigan City, Indiana, was scheduled to begin production about the middle of August, according to the company's Industrial Chemicals Division. Plant is manufacturing synthetic cracking catalysts and is expected to help augment the supply of this material for eastern and mid-western refiners.

Part of the installation is a spray-dryer, believed to be the largest of its kind in the world. This unit forms the microspherical catalyst in much the same way as old shot towers formed molten lead into buckshot. In the spray-dryer, however, the catalyst is atomized in a strong current of warm air, rather than being dropped from the top of tower as in the case of the buckshot.

Du Pont Shifts Personnel

David H. Conklin has been appointed assistant director of sales of du Pont's Petroleum Chemicals Division in charge of district sales offices. Joseph L. Stecher will continue as assistant director of sales of the division in charge of products and services.

At the same time Charles Wirth III, manager of the New York Eastern office of the division, has been made manager of wholesale sales in the Kinetic Chemicals Div. of the Organic Chemicals Dept. Pending appointment of a successor, New York office is in charge of E. Hearn Simpson.

Diamond Alkali Expands Two Plants

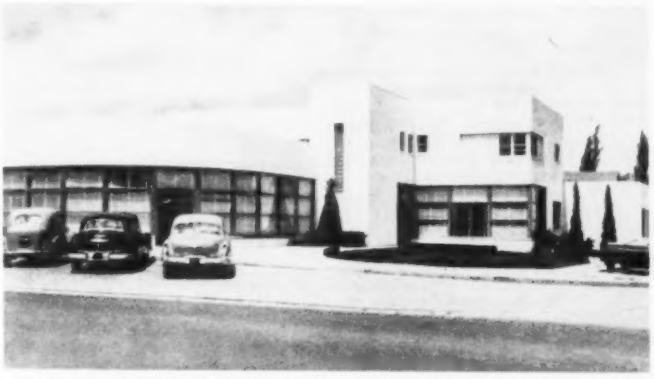
Two large expansion projects have been announced by Diamond Alkali Co. for its plants in Painesville, Ohio, and Dallas, Texas.

The Painesville program, embracing a two-year, multi-million dollar project will step up output of caustic soda and chlorine substantially by the electrolytic method and will also include construction of a new perchlorethylene plant.

Present productive capacity of chlorine and caustic soda by electrolytic method will be more than doubled, enabling the company to abandon the lime-soda process. This is expected to make available to industrial users a greater tonnage of soda ash, one of the raw materials in the lime-soda route to caustic manufacture.

Perchlorethylene, produced commercially on a limited scale since 1948 at Diamond's plant in Houston, will now be made in Painesville to meet increased demands from eastern and mid-western markets.

Expansion plans for the Dallas plant call for installation of a new large furnace for silicate production, and represent an estimated investment of several hundred thousand dollars. Full production is expected



New Carbon Black Research Center in Amarillo

New laboratory for research on carbon black, just completed and put into operation at Amarillo, Texas, by Continental Carbon Co., for whose products Witco Chemical Co. is sole distributor. Studies will be carried out on channel, furnace, and oil blacks

by early 1952. Program is being undertaken due to increasing demands in the Southwest from silica gel catalyst, detergent, soap, textile, and adhesive industries.

Corcoran Joins Kaylo in New York

Mr. Corcoran

J. A. Corcoran, who joined Kaylo Division, Owens-Illinois Glass Co. August 1, has been assigned to the New York office, covering the sales of hydrous calcium silicate heat insulating and building products.

He has had nine years' experience in the insulation field with M. W. Kellogg Co. and three years with Lummus Co. A graduate of St. Bonaventure University, St. Bonaventure, N. Y., with degree in engineering and business administration, Mr. Corcoran joined Owens-Illinois last May.

Arthur G. McKee Opens in Tulsa

Arthur G. McKee Co., Cleveland, has announced the opening of an engineering office in Tulsa to serve the Southwest. It will be headed by R. P. Mase, who has been the company's sales representative in the area and formerly was chief engineer of Jones & Laughlin Supply Co., engineering and construction division, in Tulsa.

Alcoa Adds to Alumina Capacity

Plans for increasing alumina producing capacity by 180,000 tons annually by the addition of new facilities at an existing plant in Mobile, Ala., have been announced by Aluminum Ore Co., a subsidiary of Aluminum Co. of America. The company is also currently erecting a new alumina works at Bauxite, Ark., in addition to operating its units in Mobile and at East St. Louis, Ill.

The newly announced expansion program, including that at Bauxite, will boost Alcoa's alumina capacity by approximately 70% when completed, some time late in 1952. Alumina is the first material obtained in the manufacture of aluminum metal and other aluminum chemical products from bauxite ore. About two lbs. of the oxide are used in producing one lb. of the metal.

Personnel Changes

Leeds & Northrup Co.—Dr. Raymond C. Maehler to director of research and a member of the executive committee, from associate director of research, succeeding I. Melville Stein who was recently elected to the newly-created post of executive vice president.

Shell Chemical Corp.—J. J. Lawler to manager of Chicago district office from similar post in St. Louis district, being filled by James K. Robbins, Jr.

American Meter Co. — Calvin N. Payne to Chicago District sales manager, from Kansas City sales representative position.

Davison Chemical Corp. — Dr. Stephen S. Hubard to manager of research.

Atlas Mineral Products Co.—Robert C. Evans to executive assistant to Kenneth T. Snyder, general manager of western division in Houston.

Quaker Oats Co. — Edward A. Reineck to assistant sales manager for the chemicals department, a newly-created position.

American Cyanamid Co.—Sheldon T. Dahl to west coast manager of the company's Industrial Chemicals and Plastics and Resins Divisions.

Rockwell Mfg. Co.—J. H. Sells to manager of New Orleans office, succeeding M. F. Groom.

Chiksan Co.—Howard I. Dickson to industrial salesman in Los Angeles area, from manager of sales order department at Brea, Calif., offices.

John A. Green Co.—Bruce M. Williams to sales engineer, from position as research engineer with Magnolia Petroleum Co. in Dallas field laboratory. John A. Green Co., 6815 Oriole Dr., Dallas 9, Texas, are manufacturers' representatives for test instruments, electrical equipment, and component parts.

Branches, Distributors

Otto H. York Co., Inc., East Orange, N. J., has appointed **The Rainey Co.,** 4219 Yoakum Blvd, Houston 6, Texas, as sales engineers for the south-central region.

Dy-Chek Co., Hawthorne, Calif., has made a licensing agreement with **Turco Products, Inc.,** Terminal Annex 2649, Los Angeles 54, Calif., to assume manufacturing and distribution functions for the firm's recently-announced Dy-Chek technique for metal inspection.

Metals Disintegrating Co. Inc., Elizabeth, N. J., has announced the appointment of The Roy A. Ribelin Distributing Co., 570-A M&M Bldg., Houston, Texas, as distributors in southeastern Texas.

Babcock & Wilcox Tube Co. has moved its Pacific Coast offices from 714 Olympic Blvd. to the Lawson-Chipman Bldg., 1111 Wilshire Blvd., Los Angeles.

Conoflow Corp., Philadelphia, has named Harold G. Jones Co., 502 Empire Bldg., Pittsburgh, as representatives serving that city, western Pennsylvania, and northwestern West Virginia. M. N. Aitken Co., 5960 Kansas St., Houston, has been named to represent Conoflow in Houston and the surrounding trade area from Freeport, Texas, to Lake Charles, La.

Expansion, Transition

Builders-Providence, Inc.—Richard L. Lauderdale to engineering sales staff of Builders-Pacific, Inc., from the parent company. Walter H. Brown to the projects dept., specializing in equipment applications for sewage and industrial waste treatment, from sales engineer in the standard and engineered products department.

Griscom-Russell Co. has moved its general offices from New York City to Massillon, Ohio, location of the heat exchanger plant. New York office at 285 Madison will continue as a sales office.

Wheelco Instruments Co.'s Canadian operations are now being handled by their new Canadian subsidiary, Wheelco Instruments of Canada Ltd. New company is under the personal direction of Francis Beaupre, vice president-secretary, with offices at 601 Merton St., Toronto 12, Ont.

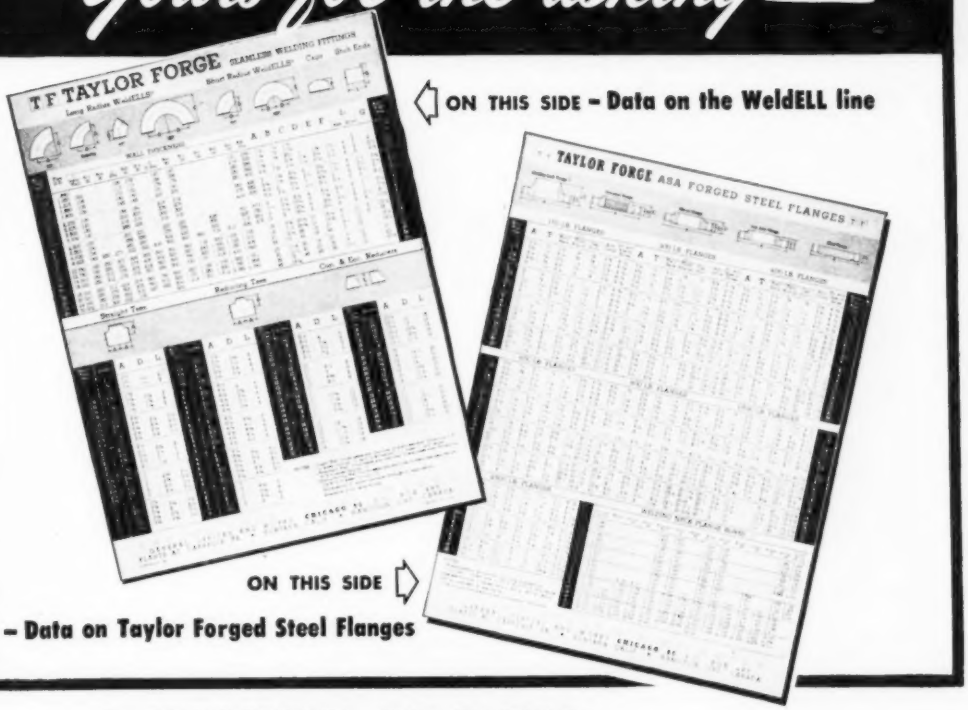
The new company will have sales and service assistance of three district agencies: Lachapelle & Archambault Ltd., Montreal; Wells H. Morton Co. Ltd., Calgary; and Instrument Service Laboratories, Vancouver.

Petro-Chem Development Co. has rented a large portion of the 15th floor of the Chanin Bldg., New York City, on a long term lease. Presently located at 120 East 41 St., the plan is to move executive and sales offices to the Chanin Bldg., 122 East 42 St., in November of this year.

Branson Instruments, Inc., have moved their facilities to a new plant at 430 Fairfield Ave., Stamford, Conn.

Battelle Memorial Institute will soon establish a European branch of its laboratories for service to the European economy. Exact location and other details will depend upon outcome of negotiations now in progress. It is anticipated the new service will be in operation early next year.

Yours for the asking—



ON THIS SIDE – Data on the WeldELL line

ON THIS SIDE – Data on Taylor Forged Steel Flanges

A VOLUME OF DATA

. . . covering welding fittings and forged steel flanges . . .

ON A SINGLE SHEET

Here is just about the handiest tool ever devised for the pipe designer. Data on welding fittings and flanges that otherwise could be found only by plowing through many catalog pages and tables have been ingeniously condensed on the two sides of the durable letter-size card illustrated above.

One side covers the broad WeldELL line of Taylor Forge welding fittings. For every nominal pipe size, ½" through 30", it shows the wall thickness for every weight of every fitting in every available material. It also shows all required dimensions of all types of fittings.

The other side covers the world's most complete line of forged steel flanges. For every nominal pipe size, ½" through 24", it gives all essential dimensional and bolting data for all types of flanges in all weights. A particularly useful table (see reproduction) is that showing welding neck flange bores which enables you to determine the I.D. of any nominal pipe size without separate calculation. Thus the sheet gives you O.D. and I.D. of any weight of pipe.

The card is varnished to make it stand the steady usage you are certain to give it. To obtain your copy see your Taylor Forge distributor or **MAIL THE COUPON.**

TF

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS

General Offices and Works: P. O. Box 485, Chicago 90, Ill.
Offices in all principal cities.
Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada

Please send me one of your fitting and flange sheets:

NAME_____

POSITION_____

COMPANY_____

STREET ADDRESS_____

CITY_____ ZONE____ STATE_____

115-0951 Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

(To obtain more data on advertised products see page 1028)

This close-up clearly shows the ribs or corrugations which add strength to Childers Jacketing and also make it form more easily around lines. Aluminum strapping and seals are a quick, inexpensive way to attach the jacketing. They can be used without any special tools and take no special training for the installers.

Does long lasting aluminum cost too much for covering your insulated lines? Not when you specify this new type weather-proof jacketing. It has been specially developed to cost little more than ordinary temporary jacketing materials.

New Low-Cost Jacketing Cuts Maintenance on Insulated Lines

AT LAST an aluminum jacket has been "engineered" especially to protect outdoor lines in refineries and chemical plants. It is the first "permanent-type" jacketing that offers both low initial cost and low application cost.

After two years of tests and major installations at 431 outdoor locations in refineries, power plants, and chemical plants, the Childers Manufacturing Co. of Houston has rung up an impressive cost-cutting record with their Childers Aluminum Jacketing.

Secret behind this low cost is the thin aluminum sheet—.006" thick—which is the weather-protecting sheath of the jacketing. It is ribbed (as pictures show) for extra strength and to facilitate forming around the line. This aluminum has proved thick enough to resist weathering and usual abrasion, but costs much less than heavier aluminum sheets.

Easy application of this Childers Jacketing cuts labor bills drastically. It comes from the factory in easy-to-handle rolls that are four feet wide and either 100 feet or 200 feet long. It is light and flexible to handle as the men put it on the line. No roll forming required as with heavy, un-crimped material. It can be cut off and attached just the same as the old-fashioned tar-paper that was sometimes used for jacketing.

You can attach Childers Jacketing around your insulated lines by one of several easy methods. The use of aluminum strapping and seals is probably the best. Sheet metal screws or Minnesota Mining's No. 471 tape can also be used.

The Childers jacketing can be removed and re-used.

A moisture barrier is attached to the back of the jacketing to give positive protection for the aluminum when it is used with alkaline insulating materials.

No painting, no rust-proofing, little maintenance—that's the advantage of aluminum!

Hundreds of design engineers and maintenance engineers have agreed they save money for their firms and trouble for themselves by changing their jacketing representatives in principal cities to make it worth your testing too—and a test roll costs only $40.00 for 400 sq. ft. (with moisture barrier attached—price for 800 sq. ft. without moisture barrier $62.00). That's a good investment in any plant. (Advt.)

* * *

FOR FULL INFORMATION write Childers Manufacturing Co., Dept. TR-2, 625 Yale St., Houston 7, Tex., for complete literature. Childers has engineering specs to Childers 100%. That should work with you on specific problems.

This is how Childers Aluminum Jacketing is shipped in easy-to-handle rolls. It is quite flexible, yet stands up under severe weathering.

Advertisement

BOOK REVIEWS

Industrial Piping Is Subject Of Newly Published Volume

Industrial Piping, by Charles T. Littleton; 6 x 9 in., vii + 394 pages, stiff cloth binding, indexed, illustrated, $8.00. McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y.

This has probably been said before—in these columns and also by many others—but it bears repeating. The old classical division of the engineering professions into mechanical, civil, electrical, chemical, metallurgical, etc. branches is no longer complete enough for today's technology. We now have highly skilled and well trained engineers who are authoritative experts in such new branches as industrial, materials handling, instrumentation, safety, corrosion, lubrication, petroleum, and petroleum refinery engineering. These newer, specialized branches require a broad knowledge in many cases of all the old classical branches. There is a trend in engineering schools to include some of these specialties in standard curricula. However, in the main, institutions still maintain their training along the classical divisions.

For these reasons, books like *Industrial Piping* are much needed practical helps to engineers who are piping designers, installation supervisors, draftsmen, and the like. The book explains the procedure for designing and erecting a modern plant from preliminary flow diagram and plot plan to final drawings. Commonly used practical methods are presented for solving pipe sizing problems. Tables of fittings are grouped according to the services for which they are generally used, for convenience in reference.

The chapter headings reveal the type of information given. They include steam, water, oil, gas, air, and instrument piping; alloy and miscellaneous piping materials; valves; insulation. A special chapter on piping cost estimation has been included. Written by R. A. Dickson, engineer with Standard Oil Co. of New Jersey, it presents the so-called "*N* System," developed by Mr. Dickson and published first in 1947 in a series of articles in *Chemical Engineering*.

Author Charles T. Littleton was formerly engineer in charge of piping with American Cyanamid Co.

Second Maintenance Meeting Papers Available in New Book

Techniques of Plant Maintenance, 1951; 8¼ x 11 in., 228 pages, illustrated, stiff cloth binding, $6.00. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

The Second Plant Maintenance Conference and Show in Cleveland last January provided a wealth of helpful information on this subject from the papers and discussions presented during the various technical sessions. These proceedings have been published in this *Techniques of Plant Maintenance*, 1951, a companion book to the volume under the same title published for the 1950 Conference, which was mimeographed.

It contains some 40 papers and is illustrated with 48 tables, diagrams, drawings, graphs, and charts. Subjects covered include preventive maintenance, inspection procedures, records and reports, personnel training, organization and management of maintenance, costs, incentive payment plans for maintenance workers, planning and scheduling, lubrication, housekeeping, painting, floors, standards, and sanitation.

Also, there are specialized discussions on electrical equipment, power plant and heating equipment, small plant problems, lighting equipment, chemical plant maintenance problems, etc.

The conference itself was sponsored by the American Society of Mechanical Engineers and the Society for the Advancement of Management.

This new second volume is far superior to the first, not only in the form of printing but also in its general organization and layout. The papers have been arranged in the same order as presented in the various sessions. Questions and answers which occurred at the end of each such session are located in the same way in the book. This makes it far easier to follow the direct discussions which pertain to the subject at hand. The first volume, unfortunately, had all questions and answers in a separate section and were extremely difficult to use. The book has been printed on good stock in large easily read type, and illustrations have been reproduced quite well. It can be considered a good reference book for the plant maintenance engineer or supervisor.

Association Publications

Symposium on Methods of Measuring Viscosity at High Rates of Shear, ASTM Special Technical Publication No. 111; 6 x 9 in., 47 pages, illustrated, soft paper cover, $1.35. A report presented originally to the API Committee on Petroleum Lubricants, November 7, 1949, Chicago, and to Research Division VII on Flow Properties, ASTM Committee D-2 on Petroleum Products and Lubricants, Feb. 24, 1950, Washington, D. C. Order direct from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Standards of Heat Exchange Institute, Barometric and Low Level Jet Condensers, 3rd Edition; 8½ x 11 in., 24 pages, illustrated, soft paper binding, $1.00. Order direct from the Heat Exchange Institute, 122 East 42nd St., New York 17, N. Y.

ASTM Standards on Gaseous Fuels, prepared by ASTM Committee D-3, April, 1951; 6 x 9 in., 144 pages, illustrated, heavy paper binding, $1.75. Order direct from American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

A Symposium on Developments in Applied Chemistry, the 25th Annual Priestley Lectures. Pennsylvania State College, Phi Lambda Upsilon and Departments of Chemistry and Chemical Engineering; 8 x 11 in., stiff paper binding, $2.00. Order from Phi Lambda Upsilon, Dept. of Chemistry, The Pennsylvania State College, State College, Pa.

Government Publications

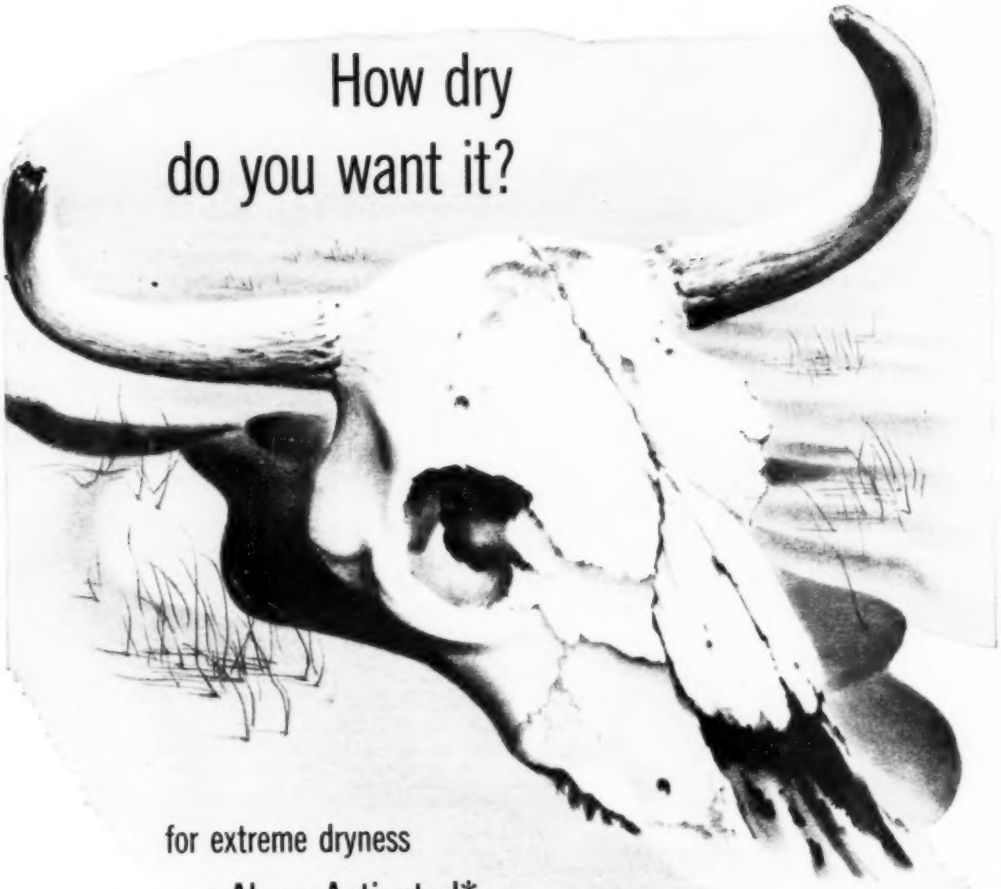
Lurgi Process, Use for Complete Gasification of Coals with Steam and Oxygen under Pressure, Bureau of Mines Bulletin 498, by J. Cooperman, J. D. Davis, W. Seymour, and W. L. Ruckes; 8 x 10¼ in., 38 pages, illustrated, heavy paper cover, 45c. Order from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Bench-Scale Studies of the Fischer-Tropsch Synthesis over Iron, Nickel, and Nickel-Cobalt Catalysts (Japan), Bureau of Mines Information Circular 7611, June, 1951, by Shiro Watanabe (revised and edited by R. C. Grass); 8 x 10½ in., 26 pages, illustrated, heavy paper cover.

Petroleum Refineries, including Cracking Plants, in the United States, January 1, 1951, Bureau of Mines Information Circular 7613, July, 1951, by J. G. Kirby; 8 x 10½ in., 11 pages, illustrated, heavy paper binding.

Order copies of the above free booklets from the U. S. Bureau of Mines, Publications Distributions Section, 4800 Forbes St., Pittsburgh 13, Penna.

How dry do you want it?



for extreme dryness you need Alcoa Activated* Alumina

Every day more and more petroleum companies are discovering the efficiency and economy of ALCOA *Activated* Alumina for the dehydration of liquids, vapors and gases. They know that it's one of the most effective desiccants they can buy. Dew points as low as *minus 100° F.*—and even lower—can be obtained, and ALCOA *Activated* Alumina can be used for an almost indefinite number of drying cycles.

ALCOA *Activated* Alumina has high resistance to crushing, shock and abrasion . . . will not soften, swell or disintegrate even when immersed in water . . . is non-toxic . . . non-corrosive . . . high in purity . . . practically iron-free.

ALCOA *Activated* Alumina is used to adsorb certain gases and vapors from gaseous mixtures, and serves as a catalyst and catalyst carrier.

What do you dry? How dry do you want it? Whatever your answer, it will pay you to investigate ALCOA *Activated* Alumina. We will gladly send you complete information. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 616J Gulf Building, Pittsburgh 19, Pennsylvania.

**Reg. T. M., Aluminum Co. of America*

FREE—A color print of this illustration on heavy 12" x 18" stock, without advertising matter, suitable for framing. Write us.

Alcoa Chemicals

ALCOA

ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • GALLIUM

API Refining Meeting Goes to Frisco; Offers of Papers Now Being Accepted

THE 17th midyear meeting of the Refining Division of the American Petroleum Institute will be held in San Francisco May 12, 13, 14 and 15, 1952, according to W. L. Stewart, Jr., vice president for refining of the API and executive vice president of Union Oil Co.

This will be the first midyear meeting of the Refining Division to be held on the Pacific Coast. The St. Francis Hotel will be headquarters.

Besides a full schedule of committee meetings, an elaborate technical program is being planned by the Program Committee under the chairmanship of W. M. Holaday, director of Socony-Vacuum Laboratories, New York. Technical sessions are tentatively planned on a number of basic refinery subjects, listed below, and offers of papers on these subjects are now being received by the committees. Offers will be approved at the next meeting of the Program Committee, scheduled for the first week in November.

Tentative Program Subjects

Corrosion and Corrosion Prevention
E. Q. Camp, Humble Oil & Refining Co.
Box 3538, Baytown, Texas

Electrical Equipment
L. M. Goldsmith, Atlantic Refining Co.
260 S. Broad St., Philadelphia 2, Pa.

Analytical Research
E. L. Baldeschwieler, Standard Oil Development Co.
Box 51, Linden, N. J.

Waste Disposal
L. Mittelman, Tide Water Associated Oil Co.
79 New Montgomery St., San Francisco, Calif.

Training Personnel
T. M. Rushing, The Texas Co.
135 East 42nd St., New York 17, N. Y.

Automotive Fuels and Lubricants
T. B. Reedel, Shell Oil Co.
50 West 50th St., New York 20, N. Y.

New Refining Processes
W. T. Gunn, American Petroleum Institute
50 West 50th St., New York 20, N. Y.

WPRA—How to Fight Fire

REFINERS in the Rocky Mountain region will have a chance to see some actual refinery fires put out with the latest fire-fighting equipment at the regional meeting of the Western Petroleum Refiners Association in Casper, Wyo. this month. The meeting is being held Sept. 20 and 21, at the Hotel Henning.

John C. Day, association secretary, has announced that officials of the Socony-Vacuum Oil Co. have invited guests at the meeting to come to their plant in Casper for the demonstration. New equipment using CO_2 Foam and Dry Powder will be shown in operation.

The fire-fighting demonstration will climax the two-day meeting, which is scheduled to begin at 10 a.m. on Sept. 20.

The first day of the conclave will be devoted to talks on refinery industrial relations problems. Four speakers are scheduled to appear. An informal dinner and a cocktail party are also slated for the first day.

Three technical papers will be given on Sept. 21. The papers are: "Octane Numbers" by A. D. Puckett of the du Pont Co.; "Refining of Green River Shale Oil" by S. S. Tihen of the Bureau of Mines Experiment Station in Laramie; and "Application of Radiant Heat to Vis-Breaking and Vacuum Operations" by J. W. Sandberg of Phillips Petroleum Co.

ASME—Conservation of Men and Materials

APPROXIMATELY 40 papers dealing with the mechanical engineering aspects of petroleum refining transportation and production are scheduled for presentation at the Sixth Annual Petroleum Mechanical Engineering Conference at Tulsa's Mayo Hotel, Sept. 24-26. Theme of the meeting, sponsored by the Petroleum Division of the American Society of Mechanical Engineers, will be "Conservation of Manpower and Materials."

Among papers of particular interest to refinery engineers are the following titles: "Analysis of Some Corrosion Problems in Petroleum Refineries," "Valves to Combat Corrosion," "Automatic Control of Flow in Refineries," "Flow Testing High Capacity Pressure Relief Valves," "Stresses in a Pressure Vessel with a Conical Head," "A New High Yield Strength Alloy Steel for Welded Structures," "Vinyl Resin Coatings in Petroleum Refineries" and "Techniques of Cost Estimating for Refineries."

ASME's Mid-Continent Section, hosts for the conference, have planned an interesting social program, including inspection trips to nearby plants and a Barbecued Buffalo Supper.

ASME—Graphitization

THE subject of graphitization of steel in refinery vessels is scheduled to be discussed at the annual meeting of the American Society of Mechanical Engineers in Atlantic City, N. J., during the week of Nov. 25.

A preliminary outline of the program includes a paper "Graphitization in Catalytic Cracking Unit Reactors," to be presented at the session Petroleum I—Effect of Temperature on Metals I, set for Thursday, Nov. 29, at 9:30 a.m. The paper is to be given by Messrs. D. B. Rossheim, J. J. Murphy, W. B. Hoyt and H. S. Blumberg from the M. W. Kellogg Co. At the same session a paper will be given by M. A. Scheil, A. O. Smith Corp., on "Embrittlement of High Chromium Steels at Elevated Temperatures."

Oil Man's Calendar

SEPTEMBER

16-19, American Institute of Chemical Engineers, regional meeting, Sheraton Hotel, Rochester, N. Y.

20-21, Western Petroleum Refiners Association, regional meeting, Hotel Henning, Casper, Wyo.

24-25, Independent Oil Compounders Assn., Fourth annual meeting, Detroit-Leland Hotel, Detroit.

24-26, American Society of Mechanical Engineers, 6th annual petroleum mechanical engineering conference, Mayo Hotel, Tulsa, Okla.

26-21, American Society of Mechanical Engineers, fall meeting, Radisson Hotel, Minneapolis, Minn.

OCTOBER

4-5, California Natural Gasoline Assn., 26th annual fall meeting, Ambassador Hotel, Los Angeles.

7-11, ASTM Committee D-2 on Petroleum Products and Lubricants, meeting, Chicago.

8-10, American Oil Chemists' Society, fall meeting, Edgewater Beach Hotel, Chicago, Ill.

8-12, National Safety Council, 39th national congress and exhibition, Hotel Stevens, Chicago.

9-12, Scientific Apparatus Makers Ass'n., midyear meeting, Recorder-Controller Section, Seaview Country Club, Absecon, N. J.

14-20, OIL PROGRESS WEEK

14-20, Oil Industry Information Committee, Oil Progress Week meeting, Roosevelt Hotel, New Orleans, La.

15-17, American Gas Association, annual convention, Kiel Auditorium, St. Louis, Mo.

15-19, National Metal Congress & Exposition, Detroit: American Society for Metals and the Society for Non-Destructive Testing, Hotel Statler; American Welding Society, Hotel Book-Cadillac; American Institute of Mining & Metallurgical Engineers, Hotel Detroit-Leland.

18-19, Scientific Apparatus Makers Ass'n., midyear meeting, Industrial Instruments Section, Seaview Country Club, Absecon, N. J.

18-20, National Association of Corrosion Engineers, south central region annual meeting, Corpus Christi, Texas.

19, Natural Gasoline Assn. of America, Southern regional meeting, Blackstone Hotel, Tyler, Texas.

22-24, Packaging Institute, 13th annual forum, Hotel Commodore, New York.

22-26, American Institute of Electrical Engineers, fall general meeting, Hotel Cleveland, Cleveland, Ohio.

29-30, Society of Automotive Engineers, Diesel engine meeting, Drake Hotel, Chicago.

29-31, Society of Automotive Engineers, transportation meeting, Hotel Knickerbocker, Chicago.

29-31, National Lubricating Grease Institute, 19th annual meeting, Edgewater Beach Hotel, Chicago.

31-Nov. 1, Society of Automotive Engineers, fuels and lubricants meeting, Drake Hotel, Chicago.

NOVEMBER

5-8, American Petroleum Institute, 31st annual meeting, Stevens and Palmer House Hotels, Chicago.

8-10, Seminar—Operations Research in Industry and Business, Case Institute of Technology, Cleveland, Ohio.

12-15, National Electrical Manufacturers' Association, Chalfonte-Haddon Hall Hotel, Atlantic City.

25-30, American Society of Mechanical Engineers, annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City.

• Internal
• Top Flange Mounted
Liquid Level Controller !

The new BS&B "Climax" Type 887 top flange mounted Liquid Level Control is the ideal, economical installation where a corrosive medium precludes the use of external piping. The type 887 is exactly the same as the amazing new 888 without lower cage housing. A hanger is provided to position the displacement element at the required level.

New Cone Point Pivot is practically friction-free. Torque tube and housing is *removable and reversible* without dismantling controller housing. You can employ *two* torque tube housings for two pilots and or mercury switches!

Standard unit may be used for interface level control between two non-miscible liquids. Special floats available for specific gravity indication or control.

Available in three- and four-inch ASA flange sizes in iron, steel or special alloys. Larger size steel or special alloy flanges available for special applications. Write for new, fully illustrated catalog today!

BLACK, SIVALLS & BRYSON, Inc.
Adv. Dept., Rm. 55D 7502 East 12th Street
Kansas City 3, Missouri

BS&B

"Climax" Type 887
INTERNAL TOP FLANGE MOUNTED LIQUID LEVEL CONTROLLER

REFINING TRENDS

Current Data on Crude Runs, Product Supply and Demand

Strong Home Demand, Higher Exports Are Cutting into Gasoline Stocks

THE combination of continued high domestic consumption and a new factor in increased product exports to sources formerly supplied from Iran serves to make the seasonally high gasoline stocks much less of a burden to refiners than was indicated a few weeks ago.

Gasoline stocks east of California on Mar. 31 were about 10,300,000 bbls. higher than on Mar. 31, 1950. Since that date they have been reduced nearly 22,500,000 bbls. Their total volume on Aug. 25 (API data) was 101,393,000 bbls. During the same period in 1950, gasoline stocks east of California were reduced 21,900,000 bbls., the total Aug. 26 being nearly 91,700,000 bbls.

However, the current high rate of withdrawals from stocks offsets to a considerable extent this higher actual volume. In June this year the reductions in gasoline stocks east of California were at a much lower rate than in June, 1950. In July stock withdrawals were at the rate of around 180,000 b/d, as compared with 40,000 b/d in July, 1950. In August stock withdrawals continued at around 180,000 b/d, as compared with 85,000 b/d in August, 1950.

During September, 1950, stocks east of California were drawn on by around 40,000 b/d. The volume of gasoline at present contracted in this country to replace that lost to customers abroad through the closing of the Abadan refinery is around 7,400,000 bbls., to be shipped over the last six months of this year. This in itself amounts to an average of about 40,000 b/d and actual shipments may run much heavier in the coming weeks. These abnormal export shipments, added to the normal withdrawals to meet domestic consumption demands, may bring down total gasoline stocks east of California by the last of October to about the 1950 level of around 92,000,000 bbls., some authorities believe.

Motor fuel demand at refineries continued through August at close to the July indicated rate of 3,900,000 b/d. This is close to 10% higher than for August, 1950, which began to show the effect of the war in Korea. Demand for seven months this year has been 12% greater than in 1950.

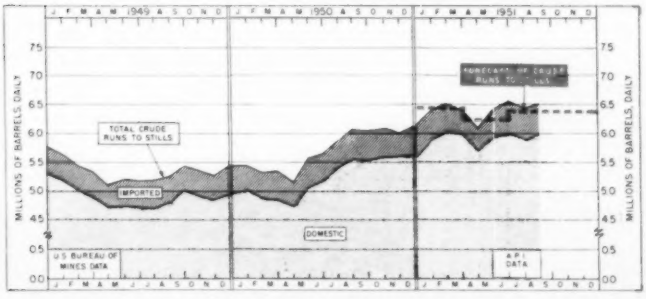
In the period from Mar. 31 to Aug. 25 this year kerosine stocks east of California built up nearly 16,000,000 bbls. and distillate stocks by close to 41,500,000 bbls., the total being 57,400,000 bbls. In the same period in 1950 (Mar. 31-Aug. 26) kerosine stocks built up nearly 11,700,000 bbls. and distillate stocks around 24,900,000 bbls., the total actual being 36,546,000 bbls. Thus, as of the last of August, the build up in heating oil stocks this year east of California is nearly 21,000,000 bbls. larger than in the same period in 1950. Stocks here were 7,430,000 bbls. higher on Mar. 31, 1951. Thus the actual volume of heating stocks east of California as of Aug. 25, 105,887,000 bbls., is over 28,000,000 bbls. higher than the volume of 77,600,000 bbls. in storage Aug. 26, 1950.

Kerosine stocks east of California are already a little higher than their 1950 peak, reached in early November, and distillate stocks are nearly 1,500,000 bbls. higher. The current buildup of these stocks continues at a high rate. However, commitments abroad to replace kerosine and gas oil lost through the closing of the Abadan refinery amount to nearly 9,000,000 bbls. over the last six months of this year, or an average of nearly 50,000 b/d. Also, the estimated increase in demand this winter over a year ago is placed around 12-14% by various authorities. In view of the anticipated domestic demand, plus coming abnormal exports, present refinery stocks are not regarded as unduly large.

In fact, the extent to which these stocks will be further increased in the period before seasonal withdrawals start is regarded as depending principally on tankage available. The withdrawal of possibly 6 to 8,000,000 bbls. or more of gasoline from storage than had been earlier anticipated will provide more storage room for heating oils. The extent to which new tankage has been built this season, and even dirty tanks cleaned out for kerosine and distillate storage, apparently will determine the level to which these stocks can be increased in coming weeks, finally reaching the highest level in industry's history.

Crude runs to stills in August appeared to be leveling off at around 6,500,000 b/d, about the same as in July, and compared with an average of around 6,400,000 b/d over the first seven months of the year. The Bureau of Mines forecast for September is 6,570,000 b/d.

Fig. 1—Crude Runs Trend Higher in August


J F M A M J J A S O N D 1949 J F M A M J J A S O N D 1950 J F M A M J J A S O N D 1951 J F M A M J J A S O N D
MILLIONS OF BARRELS DAILY
75
70
65
60
55
50
45
40
TOTAL CRUDE RUNS TO STILLS
IMPORTED
DOMESTIC
FORECAST OF CRUDE RUNS TO STILLS
U.S. BUREAU OF MINES DATA
API DATA

Crude Runs to Stills

Daily Average (1000 bbls.)

	Domestic	Foreign	TOTAL
Aug. '51 API*	5,986	529	6,515
Aug. '50 BM	5,537	530	6,067
Change	+449	−1	+448
% Change	8.1	0.2	7.4

* Through Aug. 25

Total (1000 bbls.)
(Bureau of Mines Data)

7 Mo. '51*	1,258,873	108,832	1,367,705
7 Mo. '50	1,064,561	99,070	1,163,631
Change	+194,312	+9,762	+204,074
% Change	18.2	9.8	17.5

* July from API data

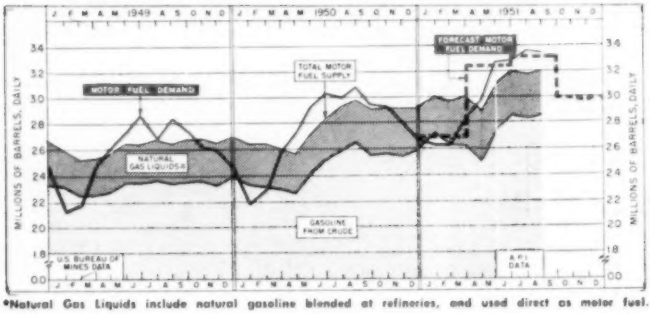
BM Forecast of Runs to Stills, 1951

(revised, June 1; 1000 b/d avg. by Quarters)
1st Q., 6,492; 2d Q., 6,351; 3d Q., 6,439; 4th Q., 6,433

Yields on Crude Runs to Stills

	Gasoline %	Kerosine %	Dist. Fuels %	Resid. Fuels %
Aug. '51, API	43.7	5.2	19.2	19.0
July '51, API	43.6	5.3	19.1	19.9
June '51, BM	43.1	5.0	19.1	19.5
Aug. '50, BM	43.8	5.3	18.1	19.1

Fig. 2—Motor Fuel Operations at High Level



*Natural Gas Liquids include natural gasoline blended at refineries, and used direct as motor fuel.

Fig. 3—Sharper Late Season Drop in "Gas" Stocks

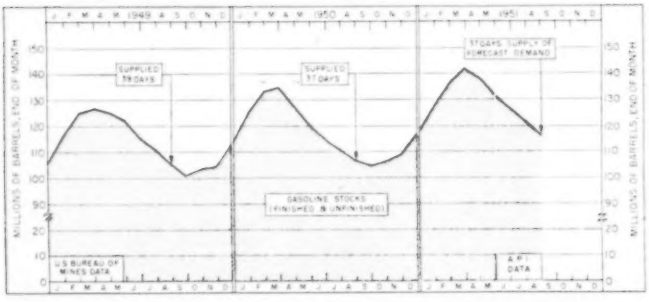

SUPPLIED 79 DAYS
SUPPLIED 77 DAYS
57 DAYS SUPPLY OF FORECAST DEMAND
GASOLINE STOCKS (FINISHED & UNFINISHED)
U.S. BUREAU OF MINES DATA
API DATA
MILLIONS OF BARRELS, END OF MONTH

Fig. 4—Heating Oil Output Nears 1,600,000 B/D

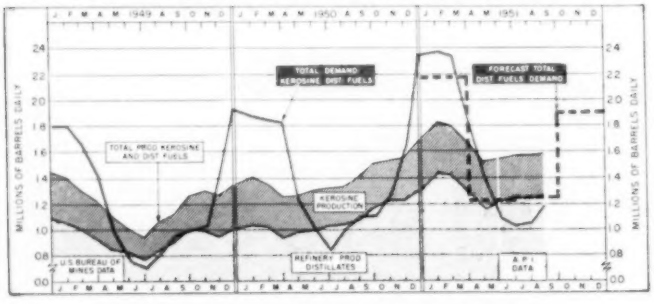
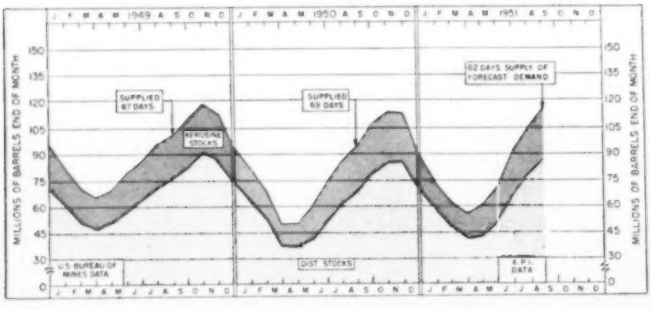

TOTAL DEMAND KEROSINE DIST FUELS
FORECAST TOTAL DIST FUELS DEMAND
TOTAL PROD KEROSINE AND DIST FUELS
KEROSINE PRODUCTION
REFINERY PROD DISTILLATES
U.S. BUREAU OF MINES DATA
API DATA
MILLIONS OF BARRELS DAILY

Fig. 5—Heating Oil Stocks Reach 1950 Peak



Motor Fuel Supply

Daily Average (1000 bbls.)

	Gasoline from Crude	Natural Blended Used Direct	TOTAL
Aug. '51, API*	2,840	365	3,205
Aug. '50, BM	2,657	333	2,990
Change	+183	+32	+215
% Change	6.9	9.6	7.5

* Through Aug. 25

Total (1000 bbls.)
(Bureau of Mines Data)

7 Mo. '51*	575,912	74,524	650,436
7 Mo. '50	507,296	67,719	575,015
Change	+68,616	+6,805	+75,421
% Change	13.5	10.0	13.1

* July from API data

Motor Fuel Demand

Including Exports
Daily Average (1000 bbls.)

Aug. '51, API*	3,385
Aug. '50, BM	3,100
Change	+285
% Change	9.2

* Through Aug. 25

Total (1000 bbls.)
(Bureau of Mines Data)

7 Mo. '51*	643,250
7 Mo. '50	573,944
Change	+69,306
% Change	12.1

* July from API data

BM Forecast of Motor Fuel Demand, 1951
(revised, June 1; 1000 b/d avg. by Quarters)
1st Q., 2,733; 2d Q., 3,265; 3d Q., 3,337; 4th Q., 3,076

Gasoline Stocks

Finished and unfinished, end of month (1000 bbls.)

Aug. '51, API*	115,954
July '51, API	120,406
June '51, BM	127,595
Aug. '50, BM	107,967

* On Aug. 25

Heating Oils Production

(Kerosins and Distillates)
Daily Average (1000 bbls.)

	Kerosine	Dist. Fuels	TOTAL
Aug. '51, API*	340	1,259	1,599
Aug. '50, BM	317	1,089	1,406
Change	+23	+161	+184
% Change	7.2	14.8	13.1

* July from API data

Total (1000 bbls.)
(Bureau of Mines Data)

7 Mo. '51*	78,218	275,728	353,006
7 Mo. '50	60,973	211,874	280,789
Change	+12,563	+59,854	+72,217
% Change	18.5	27.9	27.2

* July from API data

Heating Oils Demand

Daily Average (1000 bbls.)

	Kerosine	Dist. Fuels	TOTAL
Aug. '51, API*	250	945	1,195
Aug. '50, BM	231	883	1,114
Change	+19	+62	+81
% Change	8.2	7.0	7.3

* Through Aug. 25

Total (1000 bbls.)
(Bureau of Mines Data)

7 Mo. '51*	71,734	268,395	340,129
7 Mo. '50	64,897	229,240	294,137
Change	+6,837	+39,155	+45,992
% Change	10.5	17.1	15.6

* July from API data

BM Forecast of Heating Oils Demand, 1951
(Kerosine and Distillates)
(revised, June 1; 1000 b/d avg. by Quarters)
1st Q., 2,198; 2d Q., 1,220; 3d Q., 1,240; 4th Q., 1,902

Heating Oil Stocks

(1000 bbls. end of month)

	Kerosine	Dist. Fuels	TOTAL
Aug. '51, API*	29,504	85,543	115,047
July '51, API	27,265	77,864	105,129
June '51, BM	24,169	67,839	92,008
Aug. '50, BM	25,803	68,246	94,229

* On Aug. 25

Fig. 6—Unseasonal Drop in Residual Fuel Supply

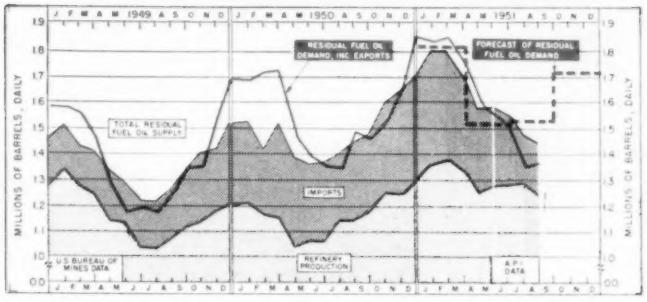
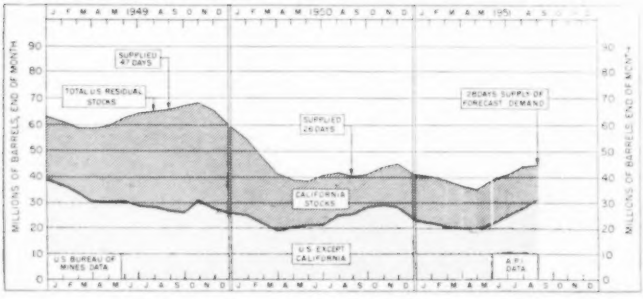


Fig. 7—Gain in "Resid" Stocks East of Calif.



Residual Fuels Production

Daily Average (1000 bbls.)

	Refinery Output	Imports	TOTAL
Aug. '51, API*	1,240	200	1,440
Aug. '50, BM	1,148	294	1,442
Change	+92	−94	−2
% Change	8.0	31.9	

* Through Aug. 25

Total (1000 bbls.)
(Bureau of Mines Data)

7 Mo. '51*	277,309	71,710	349,019
7 Mo. '50	237,853	65,921	303,774
Change	+39,456	+5,789	+45,245
% Change	16.1	8.8	14.9

* July from API data

Residual Fuels Demand

Daily Average (1000 bbls.)

Aug. '51, API*	1,370
Aug. '50, BM	1,497
Change	−127
% Change	8.5

* Through Aug. 25

Total Demand (1000 bbls.)

7 Mo. '51*	346,726
7 Mo. '50	324,732
Change	+21,994
% Change	6.8

* July from API data

BM Forecast of Residual Fuels Demand, 1951
(Revised, June 1; 1000 bbls. avg. by Quarters)
1st Q., 1,826; 2d Q., 1,521; 3d Q., 1,593; 4th Q., 1,728

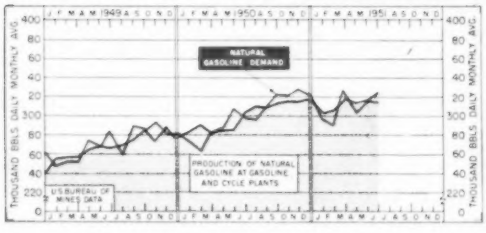
Residual Fuel Stocks

1000 bbls. end of month

	U.S. Except California	Total U.S.
Aug. '51 API*	31,179	46,753
July '51, API	28,290	43,950
Aug. '51, BM	24,916	41,568
Aug. '50, BM	26,618	40,519

* On Aug. 25

Fig. 8—Production and Demand of Natural Gas Liquids



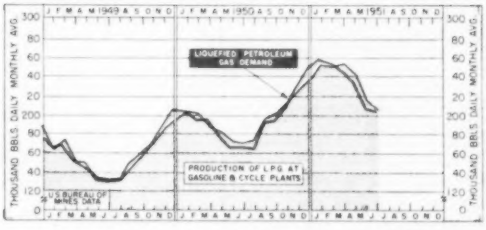
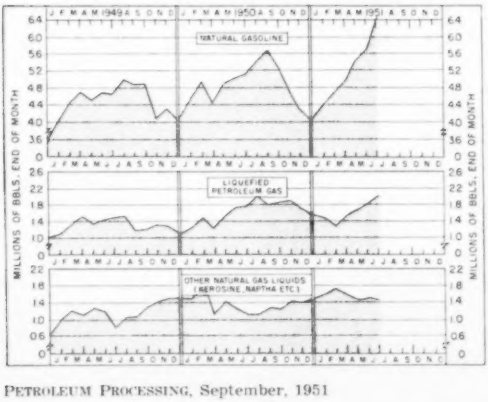


Fig. 9—Stocks of Natural Gas Liquids



Natural Gas Liquids Statistics

(Source: U. S. Bureau of Mines Report on Natural Gasoline and Cycle Plant Operations)

	Production (1000 bbl./day avg.) Natural Gasoline	LPG**	TOTAL	Demand* (1000 bbl./day avg.) Natural Gasoline	LPG	TOTAL
June '51	322	208	530	313	202	515
June '50	304	170	474	298	166	464
Change	+18	+38	+56	+15	+36	+51
% Change	5.9	22.4	11.8	5.0	21.7	10.9
	Total Production (1000 bbl.)			Total Demand (1000 bbl.)		
6 Mo. '51	56,950	43,013	99,963	55,548	42,312	97,860
6 Mo. '50	51,956	33,760	85,716	51,421	33,157	84,578
Change	+4,994	+9,253	+14,247	+4,127	+9,155	+13,282
% Change	9.6	27.4	16.6	8.0	27.6	15.7

	Stocks, End of Month (1000 gal.) — By Type of Product: Natural Gasoline	LPG	Other Products†	By Location: Refineries	Gasoline Plants	TOTAL
June '51	6,568	2,044	1,431	3,739	6,304	10,043
May '51	5,757	1,839	1,483	3,047	6,032	9,079
June '50	5,151	1,736	1,264	2,706	5,445	8,151

* Demand, including exports but not transfers, is supplied from receipts from outside sources, as well as current production and stock changes at gasoline plants. Outside receipts in June totaled 28,000 bbls.

** Does not include LPG produced at refineries which in June totaled 2,454,000 bbls.

† Includes naphtha, kerosine, specialty and other products.

ADVERTISERS' INDEX

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

●

Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card. . .no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

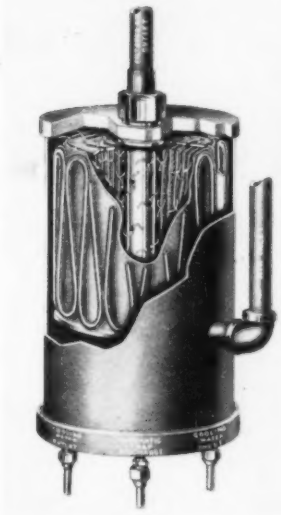
(A1) AIRETOOL MFG. CO. 1011
(A2) ALLIED CHEMICAL & DYE CORP., BAKER & ADAMSON PRODUCTS, GENERAL CHEMICAL DIV. ..... Inside Back Cover
(A3) ALUMINUM CO. OF AMERICA 954
(A4) ALUMINUM CO. OF AMERICA 1022
(A5) ANNIN CO., THE 926
(A6) BADGER & SONS CO., E. B. 938, 939
(A2) BAKER & ADAMSON PRODUCTS, GENERAL CHEMICAL DIV., ALLIED CHEMICAL & DYE CORP. ..... Inside Back Cover
(A7) BIGELOW-LIPTAK CORP. 1037
(A8) BLACK, SIVALLS & BRYSON, INC. 1024
(A9) BYRON JACKSON CO. 1001
(B1) CHICAGO BRIDGE & IRON CO. 951
(B2) CHIKSAN CO. 1032
(B3) CHILDERS MFG. CO. 1020
(B4) CONTINENTAL SUPPLY CO. ..... Facing 940
(B5) COOPER-BESSEMER CORP., THE 1003
(B6) CRANE CO., THE ..... Facing 941
(B7) CRAWFORD FITTING CO., THE 1010
(B8) DU PONT DE NEMOURS & CO., INC., E. I. 1008
(B9) DU PONT DE NEMOURS & CO., INC., E. I. ..... Facing 956, 957
(C1) ELECTRIC AUTO-LITE CO., THE 1035
(C2) ENJAY CO., INC. 1016
(C3) ETHYL CORP. ..... Facing Inside Front Cover
(C4) FOSTER WHEELER CORP. ..... Facing 1012, 1013
(C5) FOXBORO CO., THE 941
(C6) GLOBE STEEL TUBES CO. 946
(C7) GRAVER TANK & MFG CO., INC. 929
(C8) GRAVER WATER CONDITIONING CO. 962
(C9) HARDESTY CO., W. C. 947
(D1) HARTZELL PROPELLER FAN CO. 933
(D2) HUDSON ENGINEERING CORP. ..... Inside Front Cover
(D3) INTERNATIONAL NICKEL CO., INC., THE 925
KELLOGG CO., THE M. W. ... Facing 996, 997
(D4) LUMMUS CO. 956
(D5) MCKEE & CO., ARTHUR G. 943
(D6) METAL TEXTILE CORP. 1042
(D7) MINNEAPOLIS-HONEYWELL REGULATOR CO. 1004
(D8) MONSANTO CHEMICAL CO. ... 937
(D9) NATASCO CO. 1015
(E1) NATIONAL ALUMINATE CORP. 934
(E2) NICHOLSON & CO., W. H. 1038
(E3) NORDSTROM VALVE DIV. . . 998, 999
(E4) NORTON CO., THE 1033
(E5) OAKITE PRODUCTS, INC. 1034
(E6) ORBIT VALVE CO. 940
(E7) PACIFIC PUMPS, INC. 1014
(E8) PEERLESS PUMP DIV., FOOD MACHINERY & CHEMICAL CORP. 953
(E9) PETRO-CHEM DEVELOPMENT CO., INC. 942
(F1) PETROLEUM PROCESSING 930
(F2) PITTSBURGH LECTRODRYER CORP. 1040
(F3) POWELL CO., WM. 952
(F4) PRITCHARD & CO., J. F. 957
(F5) PRITCHARD & CO., J. F. 1012
(F6) REFINERY ENGINEERING CO. 944, 945
(F7) ROOTS-CONNERSVILLE BLOWER CORP. 1036
(F8) RUST-OLEUM CORP. 1006
(F9) SHELL OIL CO. 1043
(G1) SIER-BATH GEAR & PUMP CO. 1038
(G2) SWARTWOUT CO., THE 928
(G3) TAYLOR FORGE & PIPE WORKS 1019
(G4) TAYLOR INSTRUMENT CO. 960, 961
(G5) TRANE CO., THE 959
(G6) UNIVERSAL OIL PRODUCTS CO. 948, 949
(G7) VOGT MACHINE CO., HENRY 955
(G8) WELDING ENGINEERS, INC. .. 958
(G9) WOLVERINE TUBE DIV., CALUMET HECLA CONSOLIDATED 950
(H1) WYATT METAL & BOILER WORKS ..... Outside Back Cover
(H2) YARNALL-WARING CO. 1007

WHAT'S NEW!

Equipment
Materials
Processes
Literature

Reviewed by WILLIAM C. UHL, Equipment Editor

Instrument Air Filtering Unit Is Also Dehydrator and a Self-Purging Trap



The "Condensifilter Model B," for providing dry, clean compressed air for instrument lines, combines in a single unit a dehydrating device, mechanical filter and self-purging trap. Measuring 15 in. high by 9 in. in diameter, it has a capacity of 30 cfm. at 100 psi. In operation, air is passed in through the side and is directed through the condensing section where it is dehydrated, and then through the mechanical filter. Total pressure drop across the Model B is less than 2 psi. at 100 psi. working pressure. The condensing section, which removes water in both entrained and vapor states, is composed of a series of copper coils through which cold water flows. In passing through this section, air temperature is reduced to within 2° of coolant temperature. Then when the air warms to atmospheric temperature again, a spread between temperature and dew point is effected. The filtering section is made of five hexagonal chambers in parallel, each wrapped with seven layers of canton flannel. It provides over four sq. ft. of filtering area, and removes pieces down to one to two micron size. Hankison Corp., 330 Renton Bldg., Pittsburgh 33, Pa.

Circle No. **1** *on Reply Card*

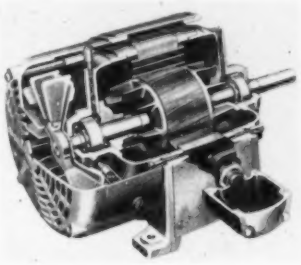
For More Information

Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage required.

Cathodic Protection Is Installed In Refinery's Open Type Condenser Boxes

Open type condenser boxes at Standard Oil Co.'s (Ohio) refinery in Cleveland are now being protected against electrolytic corrosion by an installation of Harco cathodic protection equipment. Operated on direct current from selenium rectifiers, the equipment consists of special electrodes immersed in the water from the top of the open boxes, as shown in the photograph, thus preventing corrosion on the coils and box surfaces. Manufacturer states that the installation considers all factors, such as water and metal chemical characteristics, dissolved oxygen content of the water, temperatures, protective coatings already in place, spacing of pipe coils and supporting frames, and dissimilar metals. The equipment will reduce maintenance costs, eliminate replacement, and reduce down time, it is said. The Harco Corp., 16963 Broadway, Cleveland, Ohio.

Circle No. **2** *on Reply Card*



Explosion-Proof Motor Is Offered in Horsepower Capacities from 3 to 75

A new, totally-enclosed motor for explosion - proof requirements has been announced recently with capacities ranging from 3 to 75 hp. It carries the Underwriters' label in Class I, Group D, for inflammable gases and volatile liquids; and in Class II, Groups F and G, for combustible dusts. Safety is obtained by some of the following features, according to the manufacturer: sealed terminal, elongated spark-arresting bearing sleeves, high draft ventilation, asbestos-protected windings, etc. U. S. Electrical Motors, Inc., 200 East Slauson Ave., Los Angeles 54, Calif.

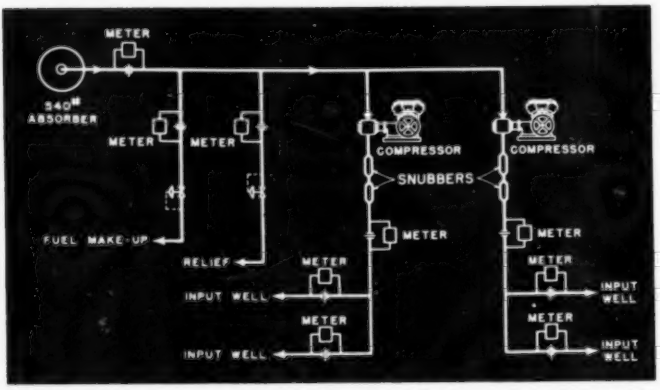
Circle No. **3** *on Reply Card*

New Lead Naphthenate Is Developed For Use in Lead-Grease Lubricants

A grease grade lead naphthenate in two metal concentrations, 30% and 33%, is being produced especially for applications in lead-grease lubricants and is said to be effective due to its solubility and stability in lube oils and greases, its anti-corrosive properties, and its enhancing of film strength, oiliness, and anti-seize characteristics. By itself, the material exhibits moderate extreme pressure properties and, when used in combination with special E. P. additives, does not detract from the lubricant. In a typical lube oil of 120 SSU @ 210° F., a 7.5% concentration gives a Timken Test of 9250 psi. equivalent at 32 lbs., maximum beam load. Witco Chemical Co., 295 Madison Ave., New York 17, N. Y.

Circle No. **4** *on Reply Card*

Snubbers Solve High Pressure Metering Problem



Snubber arrangement on compressor discharge in pressure maintenance plant of mid-west company

The use of snubbers to control gas surge in petroleum and petro-chemical operations has resulted in one novel installation recently which solved a metering problem in gas lines leading to input wells used for pressure maintenance purposes. It was described by the director of natural gasoline and gas operations for a mid-west petroleum company.

A set of tandem snubbers did away with erratic behavior of the meters, balanced up the total amount of gas placed into the input wells with the amount of gas flowing from a 540-psi. absorber, and for the first time gave the company a quick and accurate means of discovering gas leaks in the installation, thus saving large quantities of gas.

Originally, gas flowed from the absorber to two compressors and thence at high pressure to the four input wells. A meter was installed at the absorber output side and one at the head of each of the wells. The sum of input meter volumes on the discharge of both sets of compressors was compared to the volume of gas passing to the compressors. It was found to vary as much as 35%, with the volume shown on the input meters nearly always being low.

It was finally decided to install so-called "master" meters on the compressors' discharge. However, it was recognized that these meters could not be relied upon for accuracy because of pulsations from the compressor some 200 ft. away.

The use of snubbers in each line between compressors and master meters was then adopted, following a test run using snubbers in one discharge line and none in the other. With completion of the final entire installation, it was noticed that the master meter on one set of compressors checked satisfactorily with the sum of the input well meters on the same system, whereas there was a considerable difference in the other system. This indicated there were leaks in the latter system, which subsequently were found and repaired. Following that, the second master meter checked closely also with the sum of input well meters in its system.

An important result of the installation is establishment of proof that the input well meters are registering the correct volume of gas flows. Secondly, daily checks on meter readings give an immediate indication of leaks. Thirdly, it is now reasonable to assume that pulsations of the compressors is also affecting measurement on the relief, fuel make-up, and master meter on the absorber.

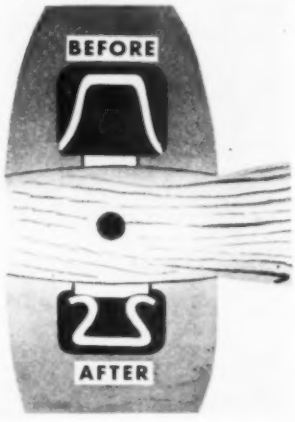
The snubbers are not tuned for suppression of surge at specific frequencies and since standing pattern along pipes is not fixed, they may be located in any convenient place ahead of the meters. The snubbers are manufactured by Burgess-Manning Co., 1203 Dragon St., Dallas, Texas.

Circle No. 5 on Reply Card

Cupcase Thermometer Made Narrow To Fit 2-in. Gage Pipe Openings

A new cupcase thermometer, narrow enough to fit into 2-in. gage pipes in oil storage tanks, has been developed which meets ASTM specifications. It was designed for use where temperature is an important factor in determining the volume of oil at the time of sale. Known as the TAG, Model 8652, the thermometer has a cup capacity of 100 ml. as compared with smaller types of from 20 to 60 ml. capacity. The thermal inertia resulting from the larger capacity provides greater resistance to temperature change as the instrument is raised out of the tank. The bulb is positioned 5/8 in. from the nearest wall of the cup and almost centered. A slanting top on both sides of the cup prevents catching on obstructions. Made of non-sparking metal, the cup is 1¾ in. in diameter. Overall length of the instrument is 16 in. Two scale ranges are available for the thermometer: 0 to 180 F. (ASTM 59F-48T), and -30 to 120 F. (ASTM 58F-48T); in 1° graduations. Tagliabue Instruments Div., Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.

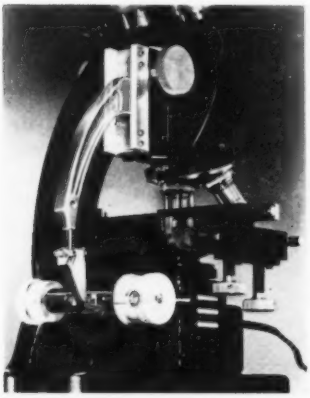
Circle No. 6 on Reply Card



Unique Safety Hammer Will Not Chip, Spark, or Mushroom in Heavy Use

The "Custanite Spring-Flo" safety hammer employs a novel design which prevents it from chipping, sparking, or mushrooming. Made of a special alloy, it contains a hardened, high-carbon ribbon steel spring at either end of the head. This results in a controlled flow of metal in the head despite continuous heavy use. The hammer retains its original weight and balance because no metal is lost when in use. Head is pinned through-and-through to the hickory handle with a heavy brass pin. Manufacturer states the hammer is guaranteed to outlast lead hammers 8 times, rawhide hammers 5 times, and solid copper or bronze hammers 3 times. It is available in six sizes from ¾ to 6 lbs. Charles Budd Corp., New Rochelle, N. Y.

Circle No. 7 on Reply Card



Laboratory Microscope Adjustment Set at Low Position for Easy Use

Ball bearings and rollers throughout the focusing system are cited as features of a new line of laboratory microscopes called the "Dynoptic Labroscopes." The instruments also feature a low position fine adjustment and a mechanical stage with low controls. As a result, the operator, after setting the coarse adjustment, can rest his hand on the table and manipulate the other controls in a comfortably relaxed position. A ball bearing on the horizontal shaft of the low position fine adjustment absorbs thrust as well and provides easy turning of the focusing knob. Two rollers on the lever transfer horizontal movement of the screw to vertical travel of the focusing slide. The slide is fitted with ball bearings assembled in pressure plates. Finally, the nose piece has ball bearings around its outer rim and ball stop, a combination that assure parcentricity over a long period of use. Substage equipment, in addition to that formerly available, includes a variable focus condenser in a tubular mount which does not require a rack and pinion substage. Bausch & Lomb Optical Co., Rochester, N. Y.

Circle No. **8** *on Reply Card*

Fiber Type Silica Insulation for Jet Aircraft Shows Industrial Possibilities

A fibrous insulation developed originally in batt form for jet aircraft use is now showing wide adaptability to a number of industrial uses; among them, high temperature thermal insulation (up to 1800°F.), electric space separation (thermocouple wire insulation), filtration of hot or corrosive materials, catalyst or catalyst support, ion exchange units, and with plastic in the form of laminates. It is said to be less than half the weight and bulk of comparable materials of like insulating properties. Called "Refrasil", in the batt form it has low thermal conductivity, effective acoustical insulation, fiber diameter of 0.00020 to 0.00040 in., specific heat of 0.19, nominal thickness of 3/16 in., and surface density of 0.05 lbs./sq. ft. The H. I. Thompson Co., 1733 Cordova St., Los Angeles 7, Calif.

Circle No. **9** *on Reply Card*

"Productive Maintenance" Program Available to Aid Industry Mobilization

A plan called "Productive Maintenance", to help industry get the most productivity from existing facilities, has been developed by General Electric Co. It is designed to assist maintenance engineers in setting up a program to minimize lost production time and forced idleness due to equipment failure. In addition, it is aimed at providing better spare parts control, and smoother production at optimum output from existing equipment. As outlined by GE, the plan recommends (1) an adequate staff of trained maintenance men, (2) the tools needed to perform properly the functions of (3) regular routine checks on operating equipment, and (4) planned outage downtime of this equipment at regularly scheduled intervals. Rebuilding and modernizing is done during planned downtime with (5) an adequate stock of parts, mechanical and electrical. GE offers a Productive Maintenance Kit, a file-size package of maintenance aids to guide the maintenance engineer in establishing a working program. The kit contains an instruction bulletin, a typical balance sheet for keeping historical data on each machine, planned outage forms, and checklist forms. For further assistance, GE engineers will, on request, assist in making a complete equipment survey in the plant. General Electric Co., Schenectady 5, N. Y.

Circle No. **10** *on Reply Card*

DID YOU MISS THESE?

The following items, reviewed originally in the July "What's New!" have aroused considerable interest among readers. They are repeated here briefly as a service to those who might have missed them. For details or copies of literature, use the regular reply card in this issue.

Rapid Analyses of Light Hydrocarbons Possible in Adsorption Fractionator

A new adsorption fractionator provides accurate analyses of light hydrocarbon gases through the C_4's in one to three hrs. with about 300 ml. samples. Prior methods needed six to eight hrs., it is said. In the apparatus, gases are separated, identified, and measured by volume of separated fractions. Separation is by physical absorption. Identification is by measurement of thermal conductivities. Volume of each fraction is obtained by determining pressure change in an evacuated system. Accuracy is of the order of 0.2%. A potentiometer recorder provides a complete and automatic record of each run. Operator need not be skilled. No liquid air or other refrigerants are used. An electrical connection is the only requirement for immediate use. Burrell Corp., 2223 Fifth Ave., Pittsburgh 19, Pa.

Circle No. **11** *on Reply Card*

Quick on-the-job Angle Measurements Obtainable with Pocket Protractor

The "Mechanic's Protractor" is designed for quick, on-the-job, angle measuring problems up to 180°. It was developed for construction men, sheet metal workers, pipe layout men, welders, foremen, inspectors, engineers, etc. Three readings can be had at one setting: 1) outside angles, 2) inside angles, and 3) inches / foot against degrees, up to 24 in./ft. (63°-26"). The unit is light in weight and constructed of vinylite plastic, which is not affected by grease or water, will not burn, warp, or become illegible. Interstate Sales Co., 123 East 18th St., New York 3, N. Y.

Circle No. **12** *on Reply Card*

Gas Plant Equipment

Blaw-Knox Gas Equipment, Research Bulletin No. 2353; 20-page pamphlet on gas conditioning and equipment, including a review of a new method for determining the entrained dust and oil content of gas streams, as well as a description of the recently announced "Electroil Fogger." Blaw-Knox Co., Pittsburgh, Pa.

Circle No. **13** *on Reply Card*

Research at Du Pont

This is du Pont — The Story of Research; 28 pages in words and pictures of industrial research as carried out by E. I. du Pont de Nemours & Co., Wilmington 98, Del.

Circle No. **14** *on Reply Card*

Laboratory Desiccator Requires Small Shelf Space, Has Screw-Type Lid

The "Dri-Jar" is a new, low-priced desiccator said to be adaptable to a number and variety of laboratory samples. It may be used for storage of hot or cold crucibles in sizes from No. 0000 to 3, or of samples up to 3 x 5½ in. in size. It is constructed of transparent glass with a screw-cap lid. The shelf is of clover-leaf design providing easy regulation of hole size for crucibles. One jar will accommodate two No. 3 and up to 24 No. 0000 crucibles at one time. Attached to the lid are three steel ribs containing calibrated slots which permit various arrangements of the three-in. diameter shelves. Standard, curved-tip tongs may be used for insertion and removal of crucibles. Screw-type cap prevents the lid from popping off when hot crucibles are placed in the jar and also eliminates the use of grease. The jar measures 5½ in. wide by 6 5/8 in. high, requiring a minimum of shelf or table space. Bethlehem Apparatus Co., Inc., Hellertown, Pa.

Circle No. **15** *on Reply Card*

Molded Ring Packing Is Designed So Each Ring Is a Self-Contained Unit

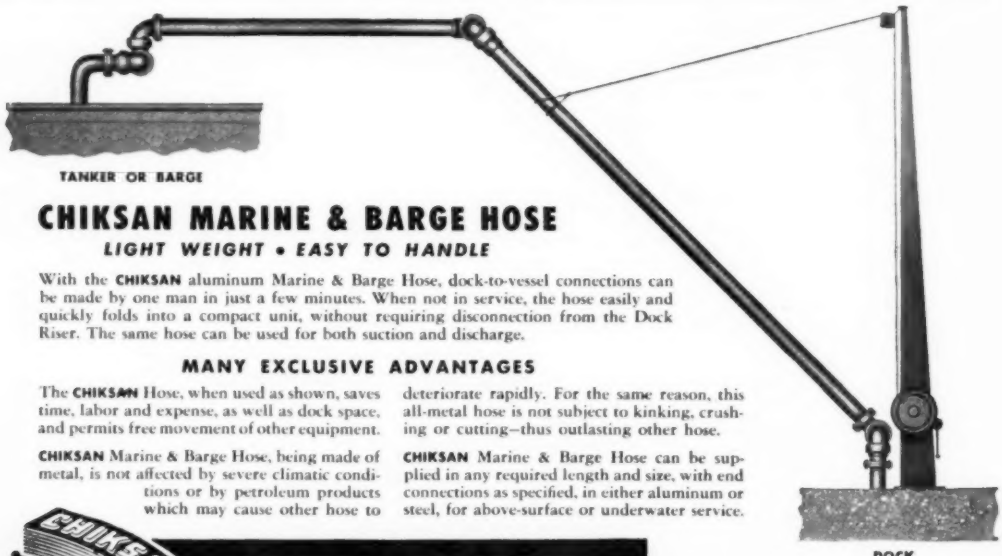
"Uneepac" is a new automatic ring packing, molded so that each ring is a complete, self - contained packing unit. No follower or header rings are needed: each ring centers itself on the preceding ring. In service, each lip is always exposed to fluid pressure. Uneepac does not depend upon gland pressure for sealing, thus friction is reduced and there is less wear on both packing and rod. It is made in various compositions to suit different services —water, steam, oil, air, gas, vacuum, etc. It is furnished in sets of endless or split rings, for shafts 5/8 in. in diameter and up. Johns-Manville, 22 East 40th St., New York 16, N. Y.

Circle No. **16** *on Reply Card*

Manila Rope Safety Insured with New Non-Conductive, hard-to-wet Product

A new safety rope which will not wet and has high electrical non-conductivity has been developed in the form of "Se-Lectric" Manila Rope. Prices are said by the manufacturer to be comparable to other conventional ropes. In comparison tests with treated and untreated manila ropes, Se-Lectric has been shown to be highly satisfactory as a safety material. In one example: where it required 5 kv impressed on a 5-ft. length of untreated ½-in. rope to produce 10 milliamps. of current, 73 kv were required in a 5-ft. length of ½-in. Se-Lectric rope. Both ropes had been showered with water for two hours before the tests. South Eastern Cordage, 656 N.B.C. Bldg., Cleveland 14, Ohio.

Circle No. **17** *on Reply Card*



CHIKSAN MARINE & BARGE HOSE

LIGHT WEIGHT • EASY TO HANDLE

With the **CHIKSAN** aluminum Marine & Barge Hose, dock-to-vessel connections can be made by one man in just a few minutes. When not in service, the hose easily and quickly folds into a compact unit, without requiring disconnection from the Dock Riser. The same hose can be used for both suction and discharge.

MANY EXCLUSIVE ADVANTAGES

The **CHIKSAN** Hose, when used as shown, saves time, labor and expense, as well as dock space, and permits free movement of other equipment.

CHIKSAN Marine & Barge Hose, being made of metal, is not affected by severe climatic conditions or by petroleum products which may cause other hose to deteriorate rapidly. For the same reason, this all-metal hose is not subject to kinking, crushing or cutting—thus outlasting other hose.

CHIKSAN Marine & Barge Hose can be supplied in any required length and size, with end connections as specified, in either aluminum or steel, for above-surface or underwater service.

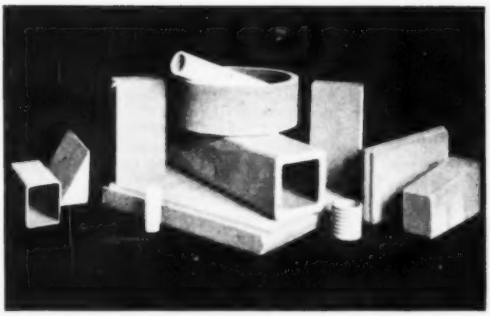
CHIKSAN TRADE MARK REG.

CHIKSAN COMPANY
AND SUBSIDIARY COMPANIES
Chicago 3, Ill. BREA, CALIFORNIA Newark 2, N. J.
WELL EQUIPMENT MFG. CORP. HOUSTON 1, TEXAS
CHIKSAN EXPORT CO. BREA, CALIFORNIA NEWARK 2, N. J.

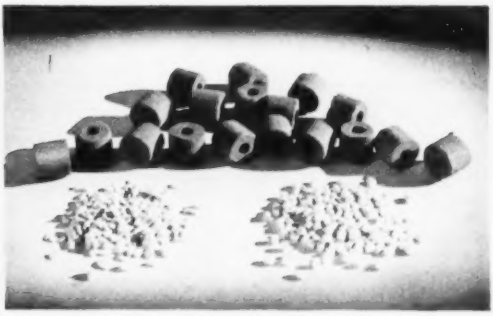
WRITE FOR COMPLETE CHIKSAN CATALOG

REPRESENTATIVES IN PRINCIPAL CITIES
SOLD BY LEADING SUPPLY STORES EVERYWHERE

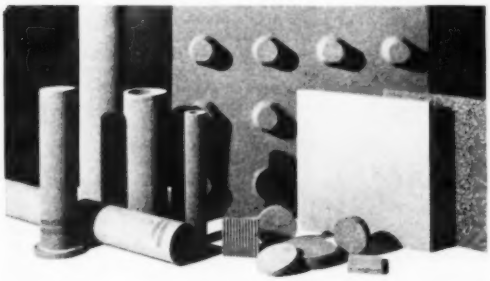
Chemical Stability
Contributes to Wider Usage of Fused Alumina



REFRACTORY SHAPES, made of Norton Alundum* mixtures containing 86% to 99.3% fused alumina, resist oxidation in reducing atmospheres at temperatures up to 3450° F. Also highly resistant to chemical attack and mechanical erosion. Write for Bulletin 803.



CATALYST SUPPORTS, made of Norton Alundum mixtures containing 77% to 89% alumina, are highly refractory, chemically inert and extremely durable. Controlled porosity provides wide range of permeabilities and surface areas. Write for experimental samples.



POROUS PLATES AND TUBES made of Norton Alundum grain fired to at least cone 12, are unaffected by acid, neutral and slightly alkaline liquors. They combine uniform permeability with great strength. Write for Bulletin 140.

LABORATORY WARE, made of highly refractory Norton Alundum mixtures containing at least 85% fused alumina (up to 99% in special mixtures), is not attacked by any organic solvent. Write for Bulletin 793.

Investigate! Maybe Norton Alundum shapes can improve your commercial or laboratory processes. The experience of Norton, pioneers in controlling the chemical and physical variables of fused alumina, is at your disposal. Contact your nearby Norton representative or write direct.

NORTON COMPANY, 594 NEW BOND ST., WORCESTER 6, MASS.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON

Special REFRACTORIES

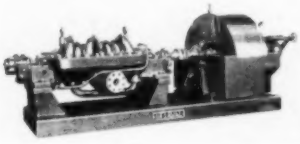
Making better products to make other products better

Canadian Representative
A. P. GREEN FIRE BRICK CO., Ltd. TORONTO, ONTARIO

Small, Portable Tube Bender Useful For Instrument Line Installations

Instrument tubing can be bent rapidly with a new lightweight, portable tube bender, the "Tal" Model 1200, which requires no vise or extra fixtures, and is designed similar to larger tools in the same line. The device makes bends up to 180 in $\frac{3}{8}$, $\frac{1}{2}$, and $\frac{5}{8}$ in. O.D., K and L copper tubing, brass, Bundy weld, steel, and other light gages. Total weight is 5 lbs. Tal Bender, Inc., Milwaukee 2, Wis.

Circle No. **18** *on Reply Card*



Multi-Stage, Opposed Impeller Pumps Applicable to Many Refinery Services

The new line of "Oppeller" multi-stage, opposed impeller, centrifugal pumps have been designed for general medium pressure and temperature service up to approximately 1000 gpm. and 1200 psi., to 350-400° F. They are said to be well-suited to boiler feed service, oil refinery services for handling liquids ranging from propane to strong caustic, and general water services. The pumps have a horizontally split casing with suction and discharge nozzles on opposite sides of the lower half of the casing. Impellers are mounted back-to-back to balance axial thrust. Volutes are staggered 180° to balance radial thrust. Bolted in stuffing box provides a means of applying a plain box with lantern ring for suction lifts; a water cooled box for high temperatures and high suction pressures; conventional or special, single or double mechanical seals or a breakdown bushing and leak-off arrangement. Pumps are furnished in four, six, or eight stages. De Laval Steam Turbine Co., Trenton 2, N. J.

Circle No. **19** *on Reply Card*

STORAGE TANKS

paint-stripped in less time—at less cost

BUT FAST—that's how old paint rolls off when you strip tanks the money-saving Oakite way.

Powerful Oakite strippers, applied by hot-flow-on, steam gun, or cold-flow-on method, actually float off paint, dirt and grease. You save time . . . no hand-scraping or chipping. You save money . . . long-life solution may be reclaimed and reused. No expensive sand blasting. And you're safe . . . no fire hazard.

Ask your local Oakite Technical Service Representative for on-the-spot demonstration. Or write for Booklet F7629. No obligation. Oakite Products, Inc., 44C Thames St., New York 6, N.Y.

SEND for this FREE Booklet. It is full of useful information on general maintenance . . . cleaning. Covers all divisions of the Petroleum Industry—production, processing, transportation, marketing.

. . . *Technical Service Representatives in Principal Cities of U. S. & Canada* . . . . .

OAKITE

PETROLEUM SERVICE DIVISION

Trade Literature

New Mercuryless Flow Meter

Differential Converter, Pneumatic Transmitter for Flow or Differential Pressure, Catalog 2281; 16 pages on a mercuryless flow meter with fast speed of response and continuous range change adjustment from 0-20 to 0-200 in. water; including operating principles, typical applications, installation methods, detailed specifications. Minneapolis-Honeywell Regulator Co., Industrial Div., Philadelphia 44, Pa.

Circle No. **20** *on Reply Card*

Use of Medium Carbon Tube Steels

B&W Alloy Steel Tubing, Bulletin TDC 141; offers assistance in solving problems in the use of alternate grades of medium carbon, or full hardening, grades of tubing steels, with condensed data on microstructure, critical points effect of alloy elements, forging, machining, welding, and thermal treatment for 14 types. Babcock & Wilcox Co., Beaver Falls, Pa.

Circle No. **21** *on Reply Card*

Entrainment Separators

Anderson "Hi-EF" Purifier, Condensed Bulletin 100; describes an internal type purifier and scrubber designed for virtually 100% entrainment separation, with recommended installations inside steam drums, flash tanks, bubble-cap and packed towers, and the like. V. D. Anderson Co., 1935 West 96th St., Cleveland 2, Ohio.

Circle No. **22** *on Reply Card*

How to Cut Discharge Piping Costs

Principles of Manifold Discharge Piping Application with "Farriseal" and "Balanseal" Safety-Relief Valves, Manual 51-B; a 34-page technical report proposing the use of bellows-type and other type relief valves in discharge header systems for partial or complete elimination of back-pressure effects on tied-in valves, so as to reduce cost of discharge piping. Farris Engrg. Corp., 533 Commercial Ave., Palisades Park, N. J.

Circle No. **23** *on Reply Card*

High Temperature Refractories

Super Refractories by Carborundum; Form No. 5120; 20 pages of basic technical information on such materials as bonded silicon carbides, bonded fused aluminum oxides, bonded electric furnace mullites, and cast alumna fusions, with PCE values from Cone 37 to 40 (up to 3425°F.) The Carborundum Co., Perth Amboy, N. J.

Circle No. **24** *on Reply Card*

Steel Tubing for Processing

Steel Tubing for the Process Industries, Bulletin TA 1559; eight pages of technical data, analyses, etc., on 20 popular carbon, alloy, and stainless tubing steels, in seamless or welded form. Babcock & Wilcox Tube Co., Beaver Falls, Pa.

Circle No. **25** *on Reply Card*

High Pressure Regulators

Grove Powreactor Dome Regulators, Bulletin No. 123A-R1; 16 pages describing applications, operating principles, and features on regulators for controlling gas, liquids, and air at pressures up to 6000 psi. at up to 150°F., with connection sizes from ¼ to 2 in. Grove Regulator Co., 6529 Hollis St., Oakland 8, Calif.

Circle No. **26** *on Reply Card*

Insulation Supporting Strap

Expand-R-Strap, a four page folder describing a corrugated type steel strap that will stretch and snap back like a spring, useful in holding insulation on tanks, vessels, pipe, etc., where there is an expansion-contraction ranging up to several feet. A. J. Gerrad & Co., 1950 N. Hawthorne Ave., Melrose Park, Ill.

Circle No. **27** *on Reply Card*

Small Controlled Volume Pumps

Milton Roy Controlled Volume Pumps, Bulletin No. 151; 24 pages of technical details on reciprocating, positive displacement pumps of the controlled volume type with capacities ranging from 50 gpm. down to 3 ml. hr., including four pages of charts showing relative corrosion resistance of materials of construction to 170 chemical compounds. Milton Roy Co., 1300 East Mermaid Lane, Philadelphia 18, Pa.

Circle No. **28** *on Reply Card*

Selecting Engineering Irons

Guide to the Selection of Engineering Irons; a 28-page basic reference bulletin, primarily for design engineers, with charts, tables, and microphotographs covering nickel alloyed cast irons, with tensile levels of 30 to 80,000 psi. their properties, and uses. International Nickel Co., Dept. EZ, New York 5, N. Y.

Circle No. **29** *on Reply Card*

Entrainment Separators

Halt Entrainment Grief with Centrifix Purifiers, Bulletin G-51; illustrates and describes operation of nine types of internal, centrifugal-centripetal type purifier for air, steam, vapor, and gas applications, including use in steam boilers, process vessels, etc. Centrifix Corp., 3608 Payne Ave., Cleveland 14, Ohio.

Circle No. **30** *on Reply Card*

Pump Conversion for Corrosion

Converting Series M to Series R Durcopump. Bulletin P2; explains how a corrosion resistant centrifugal pump can be obtained from a standard model at relatively low cost and without buying replacement parts. The Duriron Co., Inc., Dayton 1, Ohio.

Circle No. **31** *on Reply Card*

Tank Venting Equipment

"Varec" Tank Equipment, Gas Control, and Safety Devices, Bulletin CP-2001; 32 pages of complete catalog information on safety and venting devices for combustible or toxic liquid and gas storage tanks in the petroleum, chemical, marine, paint and varnish, and many other industries. Vapor Recovery Systems Co., 2820 N. Alameda St., Compton, Calif.

Circle No. **32** *on Reply Card*

Gaskets and Packing

RM Packings and Gaskets, Catalog P-100C; 32 pages of catalog information on a complete line of these materials. Raybestos-Manhattan, Inc., Manheim, Penna.

Circle No. **33** *on Reply Card*

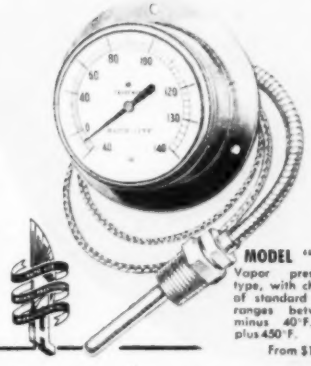
Turbine Lubrication

Turbine Oil Conditioning, Bulletin 832-P; 12 pages on dry-type oil maintenance methods for turbine bearings.

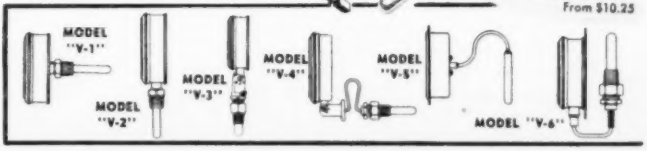
Depend on AUTO-LITE for TEMPERATURE INDICATION

Model "V" is one of many Auto-Lite dial thermometers made for industry. The outline drawings show how this temperature indicator can be adapted to meet specific needs through various standard mountings. Send for our new Catalog No. G-143-B of Auto-Lite dial indicating and recording thermometers.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION (Dept. D)
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

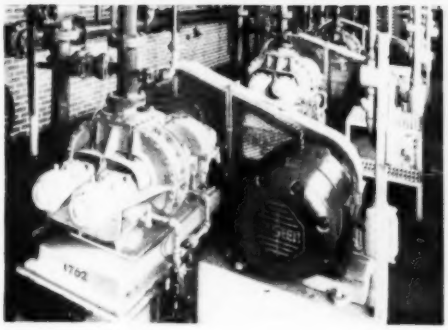


MODEL "V"
Vapor pressure type, with choice of standard dial ranges between minus 40°F. to plus 450°F.
From $10.25



(To obtain more data on advertised products see page 1028)

NO V-P-L WORRIES WITH R-C BLOWERS



ROTARY

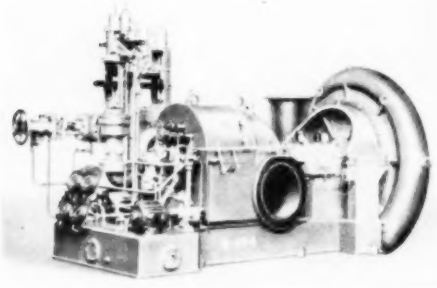
Three of many Type RCG Gas Pumps in processing plant. Capacity of each of these three is 269 cfm.

Today's production urgencies call for "no-vacation" performance from blowers and other equipment to move gas and air. You must be sure of positive Volume, at the required Pressure, and at low power cost to keep down rising expenses. The answer is Roots-Connersville Blowers with V-P-L.

You can obtain this freedom from worry by installing your choice of R-C Centrifugal or Rotary Positive equipment. This exclusive *dual-ability* gives you the choice of either type to best meet your requirements. Wide latitude in sizes, from 5 cfm to 100,000 cfm, permits selection of units with capacities close to your specific needs. Often, this flexibility saves time, cost, space, weight and power charges.

R-C engineers will gladly counsel with you on any problem of moving or measuring gas or air to keep production going.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Texas Avenue, Connersville, Indiana



CENTRIFUGAL

Type OIB Gas Exhauster. Capacity 19,000 cfm, driven by 332 hp steam turbine.

ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES

What's New!

showing various types of systems with capacities and dimensions; including also a system for maintaining insulating oil dielectric in transformers, circuit breakers, and switches. Bowser, Inc., Fort Wayne 2, Ind.

Circle No. **34** *on Reply Card*

Copper and Alloys vs. Corrosion

Corrosion Resistance of Copper and Copper Alloys, Anaconda Publication B-36; 24 pages explaining the chemical and physical nature of corrosive attack in its various forms on these metals, including a tabulation indicating relative resistance of principal copper and copper base alloys in contact with 183 corroding agents. American Brass Co., Waterbury 20, Conn.

Circle No. **35** *on Reply Card*

Condensate Return Units

General Catalog Data, Vertical Condensate Units, Section 212; six pages, including easy-to-use selection table, giving EDR sq. ft capacity in gpm., receiver capacity in gals., and range of models according to boiler pressure, with specifications for pump, receiver, motor, and accessories. Roy E. Roth Co., 2484 Fourth Ave., Rock Island, Ill.

Circle No. **36** *on Reply Card*

Instrument Air Driers

Dynamic Dehumidifiers for Instrument Air, Bulletin DD-130; four-page brochure with schematic diagram, operating information, specifications, and prices on line of instrument air driers with capacities ranging from 35 to 300 scfm. air at 100 psig. and 70° F. Industrol Corp., 472 Westfield Ave. East, Roselle Park, N. J.

Circle No. **37** *on Reply Card*

Homogenizing Pumps

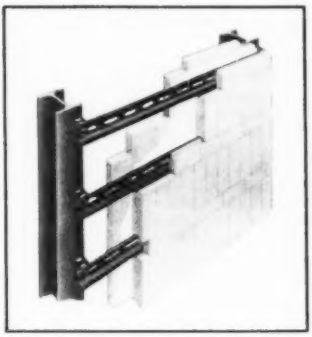
Hydropulse Hydraulic Pump, bulletin describing a new high-pressure, hydraulic pump and homogenizer recommended for this type of operation where no contamination is desired, in models with displacement range from 30 to 150 gals. hr. Scott & Williams, Inc., 350 Fifth Ave., New York 1, N. Y.

Circle No. **38** *on Reply Card*

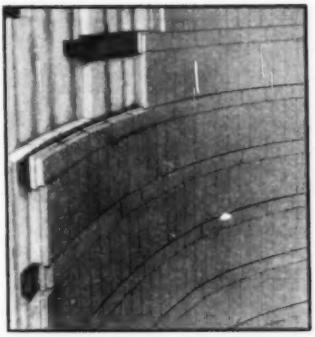
Report Preparation by Machine

2-in-1 Machine Operation for Producing Punched-Card Reports and Summary Cards, Bulletin TM 767; six-page folder with technical and descriptive information on an alphabetical tabulator with instantaneous summary card punch, useful for payroll records and other types of office work. Remington Rand Inc., 315 Fourth Ave., New York 10, N. Y.

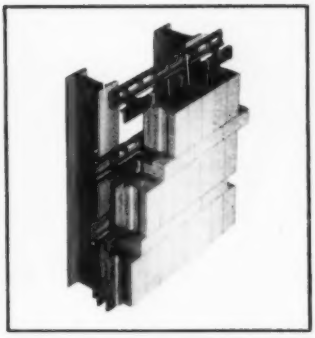
Circle No. **39** *on Reply Card*



Thin refractory walls—backed up with insulation—cut the costs of oil still installations. When tile are shaded by tubes, 3" walls are used; 4½" walls are specified for exposed walls of moderate temperatures.

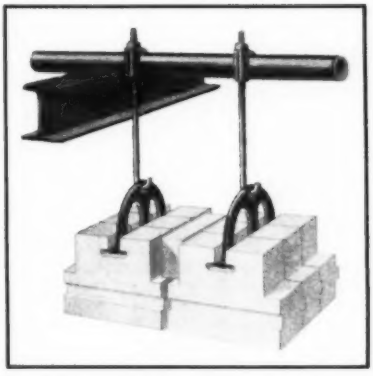


Here is a Bigelow-Liptak wall curved to fit a 25-foot diameter vessel lining. It is backed up with insulation and is hung from modified circular brackets. B-L walls and arches can follow any furnace contour.



When the going is really tough, B-L engineers select rugged 7" walls. Unit-suspended B-L walls eliminate cumulative loading and expansion. Repairs are to damaged tile, adjacent areas are untouched.

Heavy-duty B-L linings reduce oil still repairs



This pendulum-type Bigelow-Liptak arch permits the tile to swing freely in four directions. There is no cumulative loading or expansion thrusts against side walls. Arches are available in any thicknesses, follow any contour. Radial noses are similar.

Repairs are made quicker and at a much lower cost when oil stills are lined with Bigelow-Liptak walls and arches. Because heavy-duty refractories and insulation are used throughout, B-L linings stand up under the toughest of operating conditions.

Refinery boilers are enclosed with special applications of the same type of construction outlined above. When tubes are closely spaced, Bigelow-Liptak's new tube-supported wall is used. Both oil stills and boilers are covered with B-L's casing—TEXAD*. This new covering method is weatherproof, looks better, and replaces steel plate.

Catalogs describing refinery furnaces, the tube-supported wall, and TEXAD* are available upon request. Write today.

*Trademark

BIGELOW LIPTAK Corporation

BIGELOW-LIPTAK

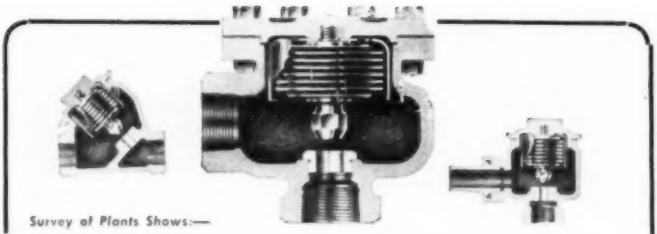
Unit-Suspended Walls & Arches

CURTIS BUILDING • DETROIT 2, MICHIGAN

IN CANADA

BIGELOW-LIPTAK OF CANADA, LTD., TORONTO, ONTARIO

ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DENVER • HOUSTON • KANSAS CITY, MO. • LOS ANGELES • MINNEAPOLIS • NEW YORK
PITTSBURGH • PORTLAND, ORE. • ST. LOUIS • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SAULT STE. MARIE, MICH. • SEATTLE • TULSA • VANCOUVER, B.C

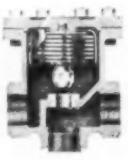


Survey of Plants Shows:—

15 of 20 Engineers Prefer Nicholson Traps

To determine the best steam trap on which to standardize, a large processing firm recently asked their plant engineers for their preference. In 15 out of 20 plants the choice was Nicholson.

The repeated adoption of Nicholson steam traps in plants currently in big "cost-reduction-through-modernization" programs is another indication of their advanced features. To learn why an increasing number of leading plants are standardizing on Nicholson thermostatic steam traps send for our catalog. 5 types for every power, heat, process use; size ¼" to 2", press. to 225 lbs.

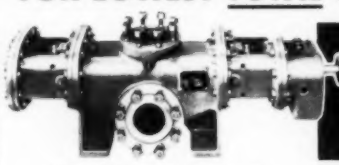


Catalog 751 or see Sweet's

W. H. NICHOLSON & CO. 215 OREGON STREET WILKES - BARRE, PA.

PUMP ABRASIVE MATERIALS?

FOR LOWEST TOTAL COST, Specify...



Sier-Bath SCREW PUMPS

● Pump shown: new External Gear & Bearing Bracket Type for non-lubricating fluids, semi-fluids. Capacities 1-700 GPM; Discharge 1000 PSI for viscous liquids, 300 PSI for water.

ROTORS INEXPENSIVELY REPLACED

CASINGS INEXPENSIVELY RE-GROUND

Founded 1905 Member A.G.M.A.

Sier-Bath GEAR and PUMP CO., Inc.

BEST BUY FOR PUMPING COAL TAR, ADHESIVES, SOAPS, CRUDE OILS, ETC.

In selecting pumps for abrasive materials applications, be sure to consider *total* cost. Sier-Bath Screw Pumps—though their original cost is higher than gear pumps—in the end cost *less*. The reason: considerably lower maintenance costs. Major over-hauls are simple, inexpensive. They thus enable you to keep your installation running at top efficiency—*without* sky-rocketing your pump costs.

Sier-Bath Screw Pumps are available in horizontal or vertical construction, corrosion resistant alloys. Special bodies, stuffing boxes and bearings for high temperature applications. Sier-Bath "Gearex" Pumps for lower pressures and capacities.

WRITE FOR BULLETIN!

9271 HUDSON BLVD., NORTH BERGEN, N. J.

Also Manufacturers of Sier-Bath Gear Couplings and Precision Gears

What's New!

Resistance Welding Nickel Alloys

Resistance Welding of Nickel and High-Nickel Alloys, Technical Bulletin T-33: 32-page booklet of detailed information on the subject, illustrated with drawings and photographs, including tables on mechanical properties, chemical compositions, recommended conditions for welding, etc. International Nickel Co., Development & Research Division, 67 Wall Street, New York 5, N. Y.

Circle No. **40** *on Reply Card*

Scraper Type Heat Exchangers

Vogt Scraped Surface Exchangers, Bulletin PE-1; eight pages of technical data, dimensional drawings, and application information on heat transfer equipment for dewaxing, deoiling, crystallizing, chilling, and like services in lube oil and wax manufacture. Henry Vogt Machine Co., Louisville 10, Ky.

Circle No. **41** *on Reply Card*

Recording Electric Meters

Bristol Series 500 Recording Voltmeters and Ammeters, Bulletin E1111; 28 pages of engineering data, drawings, etc. on electric meters, featuring a new moving-iron measuring mechanism, in types for wall, switchboard, flush panel, and pole mounting, or portable use. The Bristol Co., Waterbury 20, Conn.

Circle No. **42** *on Reply Card*

Mixing Equipment

Portable Mixers, Bulletin 74; 16 pages of catalog information covering a line of portable, propeller type agitating equipment, electric motor-driven and air-motor driven. International Engrg. Inc., Dayton 1, Ohio.

Circle No. **43** *on Reply Card*

Recorder Mechanisms

Rockwell Chart Drives and Hubs, Bulletin No. 1079 Rev. 1; six-page folder covering variable speed chart drives and hubs in range from 2 hrs. to 8 and 31 days. Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Penna.

Circle No. **44** *on Reply Card*

Vertical Turbine Pumps

Vertical Turbine-Type Pumps, Form 7228, an eight-page catalog on the company's Class APH-APK line of pumps applicable to bulk liquid transfer, cooling tower, dewatering and similar services where suction is from an open source; in sizes from 6 to 30 in., to 15,000 gpm., to 250 psi. Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

Circle No. **45** *on Reply Card*

Steel Mill Scale Removal

The Phoscote Process, an 8-page booklet describing a process for removing mill scale from steel plates and shapes by immersing in baths of sulfuric acid, wash water, and phosphoric acid; providing a clean, dry surface with a coating of iron phosphate for improved paint bonding. Chicago Bridge & Iron Co., 332 So. Michigan Ave., Chicago 4, Ill.

Circle No. **46** *on Reply Card*

Boiler Plant Equipment

McDonnell Products for Special Applications; July 25, 1951 Supplemental Catalog; 20 pages of information on boiler water feeders, fuel cut-offs, float-operated switches, float valves, solvent still regulators, and special switches, with price list. McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18, Ill.

Circle No. **47** *on Reply Card*

Piping Fabrication

Piping Fabrication and Erection, Bulletin 1700; 24 pages describing the company's facilities for handling this work on industrial installations, including oil refineries, power stations, gas transmission, and the like. Dravo Corp. Neville Island, Pittsburgh 25, Penna.

Circle No. **48** *on Reply Card*

Catalytic Fume Eliminator

Catalytic Fume Combustion, Bulletin B, 8-page technical bulletin describing the principle of operation and applications in industry for the Suter-Ruff catalytic process for fume elimination. Catalytic Combustion Corp., 4544 Grand River Ave., Detroit 8, Mich.

Circle No. **49** *on Reply Card*

Caustic Soda Information

Caustic Soda, 24 pages of handy reference information on this chemical, its purchasing, handling and storage, equipment design, and technical data, with charts, tables, etc., and including a separate leaflet on safe handling of caustic soda tank cars. Requests *must be written on company letterhead and addressed* to Pennsalt Chemicals, 1000 Widener Bldg., Philadelphia 7, Pa.

Do Not Use Reply Card

Piping Supports

Blaw-Knox Adjustable Pipe Hangers, Vibration Eliminators, and Supports, Catalog No. 51; 96 pages of complete engineering information, specifications, and data for the use of those who buy materials of this type or write specifications. Copies will be sent free to those interested readers *writing on their business letterheads* to Power Piping Division, Blaw-Knox Co., 1525 Pennsylvania Ave., Pittsburgh 12, Pa.

Do Not Use Reply Card

For Your Convenience

Business reply cards are included in each issue of PETROLEUM PROCESSING to assist you in obtaining more information on any items reviewed in "What's New!" You'll find them facing the first page of this section. Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the bottom of the card and drop it in the mail. No postage required.

Literature Offered in this Issue's Advertisements

Do you need detailed information on a specific subject? Check through this easy-to-use index of literature offered in this issue:

ALLOYS, for high temperature service: "High Temperature Work Sheet." See adv't. p. 1014.

CATALYSTS, cracking, microspherical and ground type: Details. See adv't. p. 934.

CATALYST SUPPORTS: Experimental samples. See adv't. p. 1033.

CONDENSER CLEANING: Bulletin 40. See adv't. p. 1011.

CONTROLLERS, process variable: Information. See adv't. pp. 960-961.

CONTROL SYSTEM, electronic, for temperature, pressure, level, and flow: Literature. See adv't. p. 928.

COOLING TOWERS: Bulletin. See adv't. inside front cover.

COOLING TOWERS: Bulletins. See adv't. p. 1012.

DEHYDRATION, by activated alumina: Information. See adv't. p. 1022.

EXTRACTION, sulfur dioxide, of catalytic cycle stocks: Information. See adv't. pp. 938-939.

FANS, cooling tower: Information. See adv't. p.933.

FITTINGS AND FLANGES: Data sheet. See adv't. p. 1019.

HEAT EXCHANGERS, air-cooled: Bulletin. See adv't. inside front cover.

HOSE, metal: Complete catalog. See adv't. p. 1032.

JACKETING, aluminum: Literature. See adv't. p. 1029.

KNOCK, engine: Assorted literature on causes. See adv't. facing pp. 956-957.

LABORATORY CHEMICALS: 1951-52 B&A Catalog. See adv't. inside back cover.

LININGS, boiler and refinery furnace: Catalogs. See adv't. p. 1037.

LIQUID LEVEL CONTROL: New catalog. See adv't. p. 1021.

MAINTENANCE, of tubing: Bulletin 48. See adv't. p. 1011.

MIST ELIMINATORS: 8-page booklet. See adv't. p. 1042.

MOTORS, ball-bearing type for tube cleaners: Bulletin 49. See adv't. p. 1011.

PAINT, rust-preventative: Complete catalog. See adv't. p. 1006.

PRESSURE TESTING: New bulletin. See adv't. p. 1003.

PUMPS, centrifugal, for fire protection service: Bulletin No. B-1500. See adv't. p. 953.

PUMPS, centrifugal, process: Bulletins 101 and 108. See adv't. p. 940.

PUMPS, screw: Bulletin. See adv't. p. 1038.

PUMPS, vertical centrifugal: Bulletin No. 51-6600. See adv't. p. 1001.

REFRACTORIES, plates and shapes, porous: Bulletin 140. See adv't. p. 1033.

REFRACTORY LABORATORY WARE: Bulletin 793. See adv't. p. 1033.

REFRACTORY SHAPES: Bulletin 803. See adv't. p. 1033.

SAFETY, Movie on gasoline tank trucks, bulletin describing. See adv't. facing pp. 956-957.

SERVICES to the petroleum industry: Booklet. See adv't. facing pp. 956-957.

STEAM TRAPS: Catalog 751. See adv't. p. 1038.

TANK CLEANING: Booklet F7629. See adv't. p. 1034.

TANK CLEANING: 52-page booklet. Serial No. A-1134. See adv't. facing pp. 956-957.

THERMOMETERS, indicating and recording: Catalog No. G-143-B. See adv't. p. 1035.

TUBE EXPANDING CONTROL: Bulletin 47. See adv't. p. 1011.

TUBE FITTINGS, for instrument lines: Descriptive literature. See adv't. p. 1010.

TUBING, alloy steel: Catalog. See adv't p. 946.

TUBING, aluminum, heat exchanger: 24-page booklet. See adv't. p. 954.

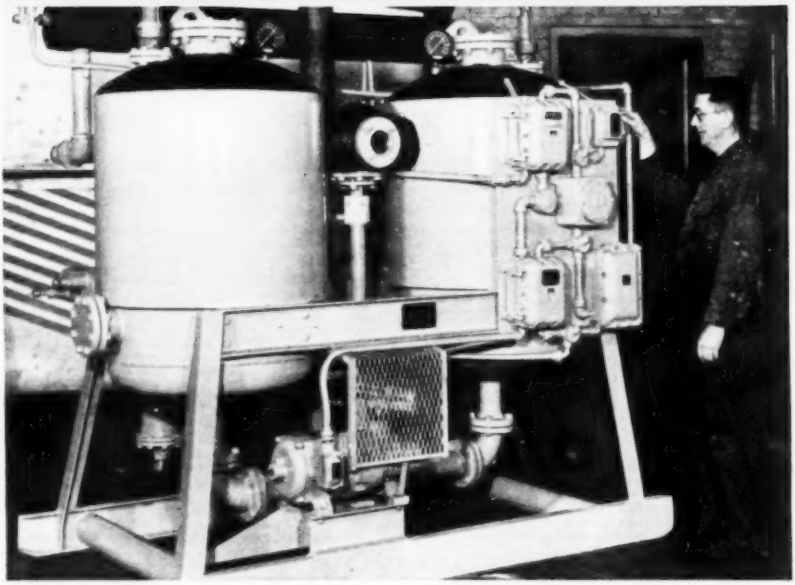
VALVES, combination control: Information. See adv't. p. 926.

VALVES, control: Bulletin 242-2. See adv't. p. 1004.

VALVES: Literature. See adv't. p. 941.

VALVES, lubricated plug type: Literature. See adv't. pp. 998-999.

for minimum DRYer investment
choose the new Lectrodryer model "BY"



Built to A. S. M. E. code. Operates on pressures up to 150 p.s.i.g. Higher pressure models optional. Wide range of capacities—to 30,000 standard c. f. m.

We stepped up the tempo for this new model "BY" Lectrodryer* to enable you to DRY air with a minimum investment in equipment.

By speeding up the DRYing cycle (reversing the DRYing-regenerating cycle oftener) the new Lectrodryer can operate with less activated alumina. This means that the "BY" Lectrodryer itself can be smaller, and hence cost less. Besides, it has only one moving part—the valve reversing mechanism. Its operation is completely automatic.

This Lectrodryer is new—but old enough to have been thoroughly tested in customers' plants.

We'll be glad to tell you more about how the new Lectrodryer model "BY" can help control your WETth problems at substantial savings in original equipment investment. Just write Pittsburgh Lectrodryer Corporation, 332 32nd Street, Pittsburgh 30, Pennsylvania.

QUICK SPECS
ON THE NEW "BY" LECTRODRYER

Fully automatic

Lower first cost

Low operating cost

Simple—
only one moving assembly

Steam or electrically reactivated

Compact

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In Australia: Birlec, Limited, 51 Parramatta Road, Glebe, Sydney.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY
WITH ACTIVATED ALUMINAS

LECTRODRYER

* REGISTERED TRADEMARK U. S. PAT. OFF.

Indiana Standard Promotes Four in Research Lab.

Mr. Bolt

Mr. Hart

Mr. Weitkamp

Mr. Proell

John A. Bolt has been promoted to division director, light oils and special products, in the Standard Oil Co. (Ind.) research laboratory at Whiting, Ind. Formerly assistant superintendent of technical service, he succeeds **Dr. Philip C. White,** who has become manager of research and development for Pan American Refining Corp. at Texas City, Tex.

H. M. Hart, group leader in the research laboratory at Standard's Sugar Creek, Mo., refinery, has been promoted to assistant superintendent of technical service at Whiting.

Wayne A. Proell and **Dr. A. W. Weitkamp** have been promoted to research associates in the research laboratory at Whiting, Ind.

Mr. Proell joined the company in 1938 as a research chemist at Whiting. He has done extensive research on petrochemicals. He was graduated from the University of Chicago.

Dr. Weitkamp, who became associated with the company in 1937 as a research chemist, has carried out fundamental studies on the composition of fatty acids and the mechanism of hydrocarbon synthesis. He did his undergraduate work at Midland College, Fremont, Neb., and received a Ph. D. from the University of Nebraska.

Mr. Bolt joined Standard in 1930 as a chemist at the Whiting laboratory. He became a group leader in 1944 and assistant superintendent of technical service in 1947. Mr. Bolt did his undergraduate work at Calvin College, Grand Rapids, Mich., and received his master of science degree in chemistry from the University of Michigan.

Mr. Hart became associated with the company as a chemical engineer at Whiting in 1940 following graduation from Montana State College. After service as a group leader with Utah Oil Refining Co. from 1943 to 1945, he returned to Standard Oil as a group leader at Sugar Creek.

* * *

Dr. John E. Kircher has been appointed manager of Continental Oil Co.'s expanded petrochemical department. His headquarters will be in the executive offices in Houston.

Dr. Kircher will be vice president and a director of Sharples-Continental Corp., Baltimore, manufacturers of base products for detergents; vice president and director of Petroleum Chemicals, Inc.; and a director of Continental Oil Black Corp.

Dr. Kircher's background in industrial chemistry is featured by his work in the synthetic detergent field and includes research in the development of synthetic rubber. He was associated with the Sharples Chemicals Inc., Philadelphia, from 1943 to 1950 in research and development work and spent the past eight months as director of development for the Stephan Chemical Co.

* * *

Austin Morgan has been named to the newly-created position of asst. chief mechanical engineer for Phillips Chemical Co. He will be located in the company's main offices at Bartlesville. Mr. Morgan previously was services superintendent at Phillips' Plains Plant at Borger, Texas.

* * *

William Kaplan has been appointed director of the automotive research laboratory for Pan American Refining Corp. in Baltimore, Md.

Mr. Kaplan received his degree in

Out of 378 annuitants at the East River operations, Brooklyn, N. Y., Socony-Vacuum Oil Co., Inc., more than half were guests of company executives recently at a luncheon in the plant cafeteria. The others were unable to attend for various reasons.

For those present, the years of service totaled 6,487 for an average of 33.79. These five men, all over 80 and with 158 years of service, were especial guests. From left to right, **Antoni Biernaczki, Charles Schell, Levi North, James Deaton and Thomas Bowes.**

Mr. Biernaczki, 80, started with the company in 1918 and retired in 1936 as a wax molder in the Pratt-Long Island Refinery. Mr. Schell, 81, started in 1885 and retired in 1925 as a laborer in the Devoe Works. Mr. North, 84, started in 1892 and retired in 1927 as a foreman in the compounding department, Grease and Compounding Works. Mr. Deaton, 82, started in 1899 and retired in 1933 as a stillman in the Sone & Fleming Refinery. Mr. Bowes, 84, started in 1895 and retired in 1929 as a mason in the Sone & Fleming Refinery.

chemical engineering in 1927 from M.I.T. and went right to work in the oil industry. In 1941 he was employed by the research department of Pan American Refining Corp. His latest position in the Texas City laboratory was as section chief in charge of technical service.

* * *

M. S. Beringer, vice president in charge of manufacturing for British American Oil Co. Ltd., has been elected vice president of B. A.-Shawinigan Ltd., the newly-organized petrochemical company, owned jointly by British American and Shawinigan Chemicals Ltd. **R. E. Irwin,** chief chemist of British American, is on the board of directors. B. A.-Shawinigan last month announced plans to build a new plant near British American's refinery in Montreal East.

* * *

Gus Kaufman has been appointed assistant manager of the technical and research division of The Texas Co. Mr. Kaufman is a lubrication specialist, whose work during World War II won him a Naval Ordnance Development award. He was graduated from Rice Institute, Houston, Texas, in 1924, and was employed by The Texas Co. shortly thereafter. From 1931 to 1941 he was in charge of grease research at Texaco's Beacon, N. Y. Laboratories. During the past 10 years he has served as staff technologist and assistant to the manager of the technical and research division in New York.

* * *

Mr. Mann

Louis D. Mann has been elected president of Cities Service Refining Corp. He succeeds **Burl S. Watson** who was recently made chairman of the corporation's executive committee.

Mr. Mann is a veteran Cities Service executive. He started with the organization in 1917 soon after receiving his B. S. from Union College. He began work as a chemist and advanced rapidly through various refinery positions.

During World War II he was manager of the Cities Service Defense Corp., Maumelle Ordnance Works at Little Rock, Arkansas. Since 1946 he has been vice president and general manager of Cities Service.

* * *

Dr. Starr

Dr. John V. Starr has been appointed assistant manager of the lubricants and specialties division of the manufacturing division of Esso Standard Oil Co. Technical assistant to the general manager of East Coast manufacturing operations at the Bayway refinery since 1946, he has also been acting manager of the Everett, Mass, refinery.

Dr. Starr was graduated from Wabash College in 1924 and joined the company in 1928 after taking his doctorate in chemistry from Cornell University. Assigned to the technical service division, he later became assistant manager of the technical service division at Bayway and was made manager in 1938.

* * *

Charles N. Kimberlin, Jr. has been named senior research associate at Esso Standard Oil Co.'s Baton Rouge refinery. He has been with the Esso Laboratories since 1933. A graduate of Louisiana College, he received a M.S. degree for organic chemistry from Louisiana State University.

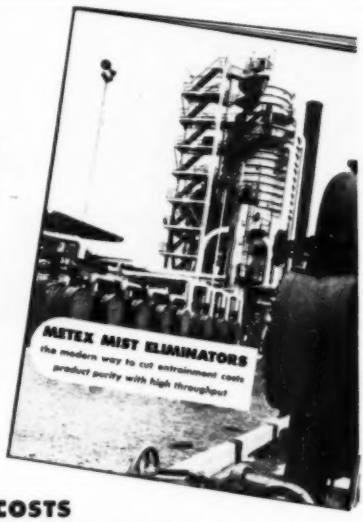
If you want . . .

INCREASED THROUGHPUT

from existing processing equipment

Get the facts on . . .

METEX MIST ELIMINATORS



In plant after plant, these knitted-wire mesh units, by removing *more than* 95% of the entrained liquids, are enabling petroleum refiners to

. . . CUT PROCESSING COSTS

. . . MAINTAIN PRODUCT QUALITY

. . . AND INCREASE OUTPUT

Furnished in sections, and cut to fit the dimensions and shapes of towers and stills, Metex Mist Eliminators can be easily installed in existing equipment. Their effectiveness also leads to further economies on new construction.

For detailed information on this modern method of coalescing and removing liquids entrained in the vapor in vacuum pipe stills, scrubbing towers, knockout drums, evaporators and similar equipment, write for your copy of our 8-page bulletin — "Metex Mist Eliminators".

METAL TEXTILE CORPORATION

631 EAST FIRST AVENUE, ROSELLE, N. J.

Metal Textile Corporation
631 East First Avenue, Roselle, N. J.

Gentlemen:

I'd like to have a copy of "Metex Mist Eliminators".

Name ..... Title .....

Company .....

Address .....

City ..... State .....

Probolog

gives accurate picture of heat exchanger tube condition . . .

Without removing tubes!

TODAY'S NEEDS place a high value on reliable tools and methods of failure-prevention. The Shell-developed Probolog is an outstanding example of such a tool.

Probolog, with speed and precision, gives you a *permanent record* of the condition of individual tubes in heat exchangers and other tube-nest equipment. This record instantly spots worn, eroded, or pitted sections of a tube.

Probolog is a one-man unit . . . simple, fast and dependable in its "judgment." It has an established record for unfailing accuracy, and for reducing maintenance costs in the inspection of non-magnetic tubular equipment.

Additional information on the Probolog will be sent upon receipt of your letterhead request.

SHELL DEVELOPMENT COMPANY

50 WEST 50TH STREET • NEW YORK 20, N. Y.

EDITORIAL VIEWPOINTS

Opinions and Comments on Current Topics

Stifling Scientific Minds

THE SHIFTING of James Boyd in the U. S. Bureau of Mines from his position as director of the Defense Minerals Administration back to his former title as Bureau director, and other recent developments in the government's synthetic liquid fuels program again focus attention on the Bureau's synthetic fuels research work.

These developments emphasize that from the start the Bureau's research program was set up on a predetermined policy. Instead of approaching the problem with an open mind, the program was manifestly directed to the purpose of establishing that a commercial synthetic liquid fuels industry was an immediate economic necessity for the country, to supplement our petroleum reserves.

The official statements on the progress of the Mines Bureau's work, contained in the Interior Secretary's annual reports, have been propaganda to support the claims for commercial plants. They were in no wise impartial and accurate reports on an extensive research project of great importance to the nation. Claims made for product recoveries and estimates of costs for commercial operations have been based on a pitifully small amount of laboratory and demonstration plant operations, especially considering the large sums of public money spent.

In all the material the Bureau has put out there has never been any reference to the great amount of work the oil companies have done over the years in their studies on synthetic liquid fuels. This despite the fact the Bureau's investigations have leaned heavily on the findings and results the oil companies achieved. On the contrary, the inference has been that the Bureau of Mines alone was experimenting with synthetic fuels, to protect the public's needs for gasoline and other liquid fuels.

The logical outcome of a research program based on a predetermined policy to supply data to support the claims for a commercial industry is now at hand. It is in the form of a proposal from Interior Secretary Chapman that $445,000,000 in public funds be spent for a 30,000 b/d coal hydrogenation plant, and for a smaller shale oil plant. The government is also asked to guarantee a price for the products that would provide the operators of the coal plant with a profit. This proposal has been railroaded past the Petroleum Administration for Defense and sent directly to the federal officials who hold the key to the national treasury, in a manner entirely in keeping with the conduct of the Bureau of Mines' experimental program. The cost figures advanced for the proposition are so out of line with conventional cost estimating that they have brought open criticism even from James Boyd, the Bureau's nominal head, and Dr. H. H. Storch, director of the Bureau's Bruceton, Pa., experiment station.

Thus the country is asked to embark on building up a commercial synthetic liquid fuels industry, with exceedingly limited and debatable experimental data to govern the type of plant to be built. We may wake up some years hence and discover that we put our synthetic liquid fuels eggs all in the wrong basket. However, this possibility is perhaps not the worst feature of the matter.

The conduct of the Bureau's experimental program on a predetermined policy without doubt stifled freedom of thought and of constructive criticism of the program by the Bureau's own investigators and other scientists. Such criticism in the early stages of the program would have insured perhaps slower but certainly sounder progress to the goal set up by Congress when it authorized the work: namely, to determine and evaluate the various methods for manufacturing synthetic liquid fuel products from raw materials available in great quantities in this country.

To stifle freedom of expression leads logically to the stifling of freedom of thought, in scientific and other fields. The government through many agencies is now sponsoring many research projects on a large and costly scale. If many of these are being approached from a predetermined policy as to what the results are to show, and if thinking of scientists on other channels of approach and their expression of such views is to be disregarded and stifled, as has happened in the Mines Bureau's synthetic liquid fuels program, the effect on scientific progress and development in this country will be devastating in the extreme.

25 Years of Petroleum Progress

THE GROWTH of the chemical industries over the past 75 years was commemorated at the Diamond Jubilee Meeting of the American Chemical Society in New York, Sept. 3-7. The ACS Petroleum Chemistry Division, for its share in the important event, had to be content with a symposium on technological progress in the past 25 years. In fact, the present period of stimulated technological developments hardly goes back that far. In less than 25 years catalytic cracking has developed into a major industrial process. Tetraethyl lead was first introduced as an antiknock agent in 1923.

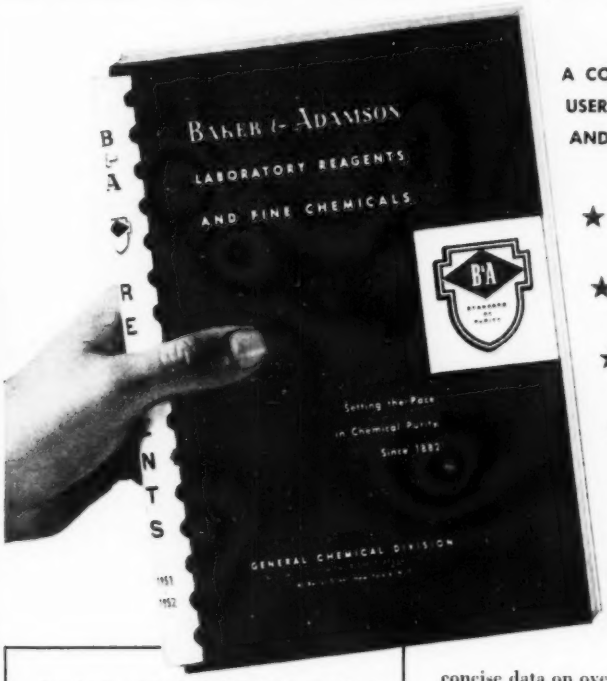
In the field of refining technology, the development now expanding most rapidly is in the use of petroleum feed stocks, such as ethylene, propylene and others, for the synthesis of chemical intermediates. Some oil companies will greatly increase their operations in this field in coming years. However, at the most the production of chemical derivatives can provide a use for only one or two per cent of the petroleum produced.

The most important field for future technological progress will continue to be in improving the manufacture and utilization of the large volume products oil companies supply direct to consumers.

Announcing...

THE BIG NEW 1951-52

B&A CATALOG of Reagents & Fine Chemicals



A COMPLETE BUYERS' GUIDE FOR USERS OF LABORATORY REAGENTS AND FINE CHEMICALS

- ★ For Manufacturing Control Laboratories
- ★ For Production Requiring Quality Chemicals
- ★ For Process Planning and Development
- ★ For Research Laboratories
- ★ For Educational Laboratories

Just off the press—Baker & Adamson's new 1951-52 Catalog is profusely illustrated . . . packed with 264 pages of important information. Gives clear, concise data on over 1,000 B&A Laboratory Reagents and Fine Chemicals! Includes such pertinent facts as grades, strengths, maximum limits of impurities, etc. If you buy or specify laboratory reagents, this new 1951-52 B&A Catalog belongs on your desk. Send for your copy today.

Packed with helpful information

STORAGE AND HANDLING: Special section gives helpful "do's and don'ts" on handling chemicals that require extra precautions.

PACKAGING SECTION: Exclusive new feature—photographs and full details on major B&A packaging, including: . . . the "PBL" Drum with polyethylene liner, the 9-bottle case for reagent acids, the 6-½ gallon carboy, the "Saftepak" plastic dispenser for HF, and many others.

EXTENSIVE DATA: Over 230 pages of specifications, other pertinent data on B&A Reagents, also on many Fine Chemicals.

Write Today Fill out coupon, attach to your business letterhead and mail today. Free to all qualified users and buyers of reagents.

BAKER & ADAMSON PRODUCTS, General Chemical Division
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Please send me your new 264 page catalog of Baker & Adamson Reagents and Fine Chemicals for 1951-52.

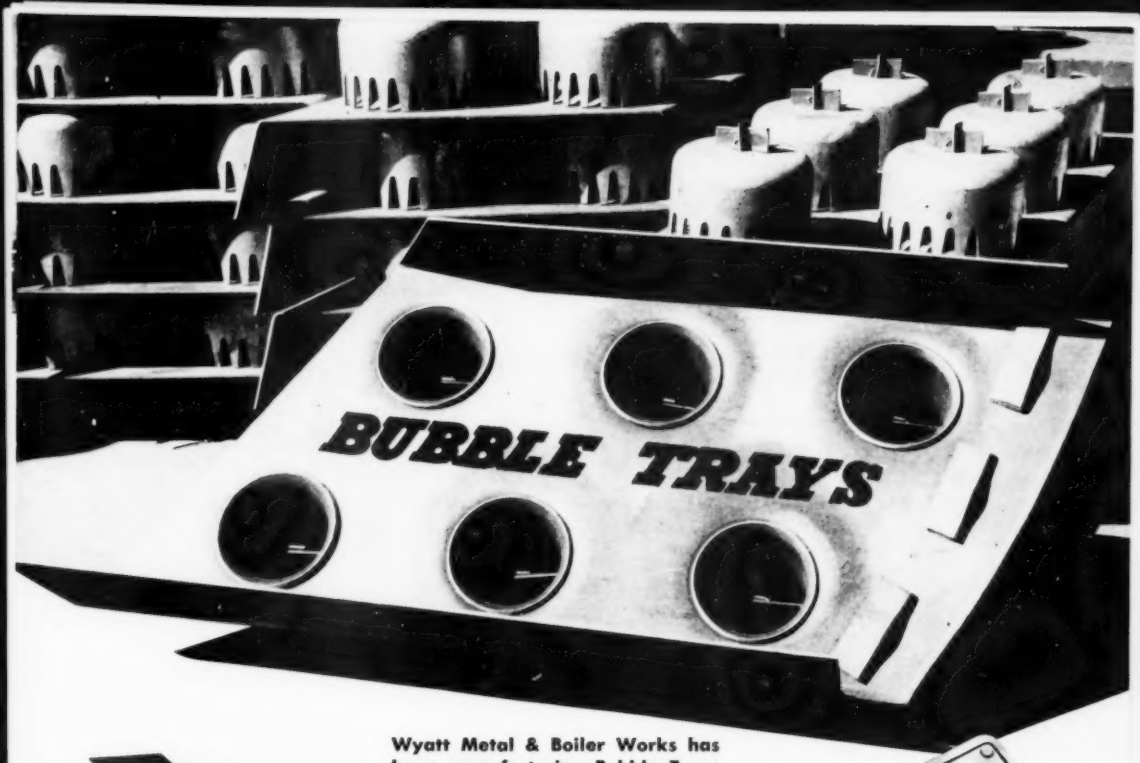
Name_____

Organization_____ Position_____

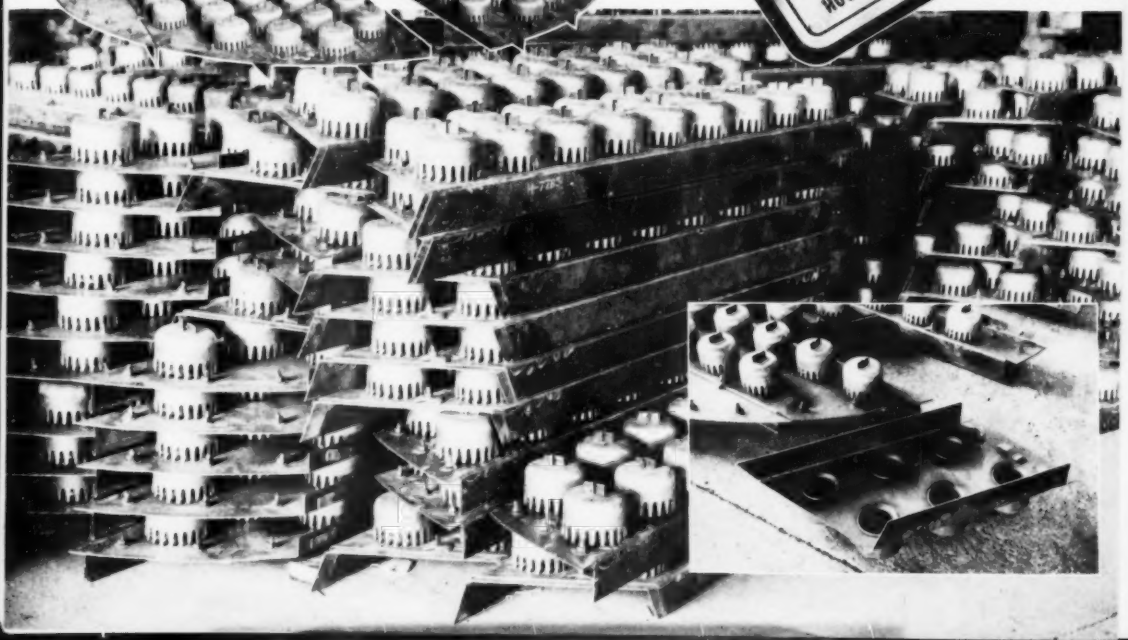
Address_____

City_____ Zone____ State_____

11-B



Wyatt Metal & Boiler Works has been manufacturing Bubble Trays for more than a third of a century. They eliminate field installation costs. Installation is made during tower fabrication.

Wyatt's
HOUSTON-DALLAS-NEW YORK-TULSA

Fabricators and Erectors Since 1913